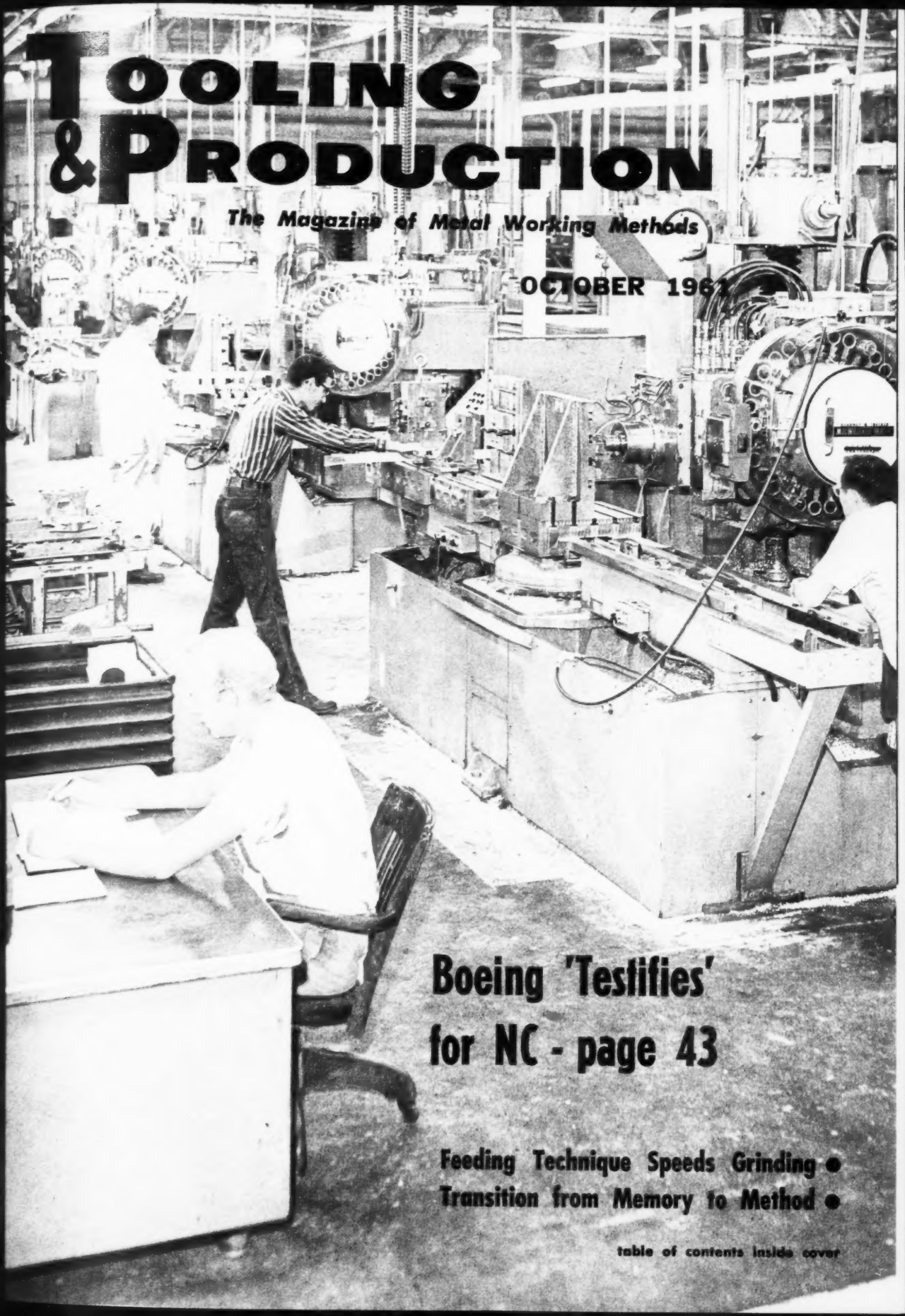
TOOLING & PRODUCTION

The Magazine of Metal Working Methods

OCTOBER 1961



Boeing 'Testifies' for NC - page 43

Feeding Technique Speeds Grinding ●
Transition from Memory to Method ●

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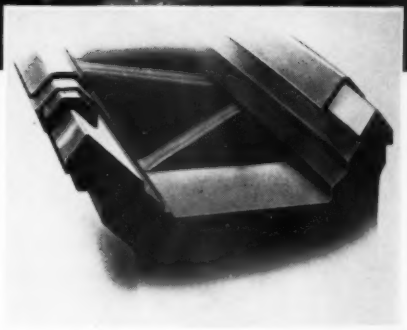
AT CANNING MACHINERY DIVISION
Food Machinery and Chemical Corporation
Hoopeston, Illinois, Plant

2-A Turret Lathe bores stainless steel cylinders to .001" tolerance

Warner & Swasey 2-A Turret Lathe provides the necessary feeds and speeds, power and rigidity for handling critical jobs in tough work materials

Long cuts in tough materials to close limits of size and finish, see typical cylinder illustrated, pose no problem to Canning Machinery Division's battery of new Warner & Swasey turret lathes.

These machines have more and higher speeds, more power and precise optical alignment of the spindle with the precision ground self-guiding "Vee-ways". In addition, engineered placement of gibs, and distribution of weight through casting sections produce the ruggedness and rigidity needed for heavy roughing cuts in the same operation with the precision finishing cuts. As this company found, old equipment simply can't compete with the new Warner & Swasey's on the "problem jobs". For full information on the line of new Warner & Swasey turning equipment, why not contact the trained Field Engineer in your area. Warner & Swasey Company, Cleveland 3, Ohio.



Accurate Vee-Ways. Precision ground ways are induction hardened for long-term accuracy. Extra protection is provided by patented telescoping way-covers which prevent damage from heavy objects, scoring by grit and chip particles, and loss of lubrication on the ways from coolant splash.

WARNER & SWASEY

YOU CAN TURN IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

CIRCLE INFORM-A-GRAM KEY NO. 2

TOOLING & PRODUCTION
The Magazine of Metal Working Methods

VOL. 27, No. 7
OCTOBER 1961

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"personally speaking . . ." **4**
Ray Huebner, Publisher

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Vol. 27, No. 7 George J. Huebner, Founder 1885-1956

TOOLING & PRODUCTION MAGAZINE

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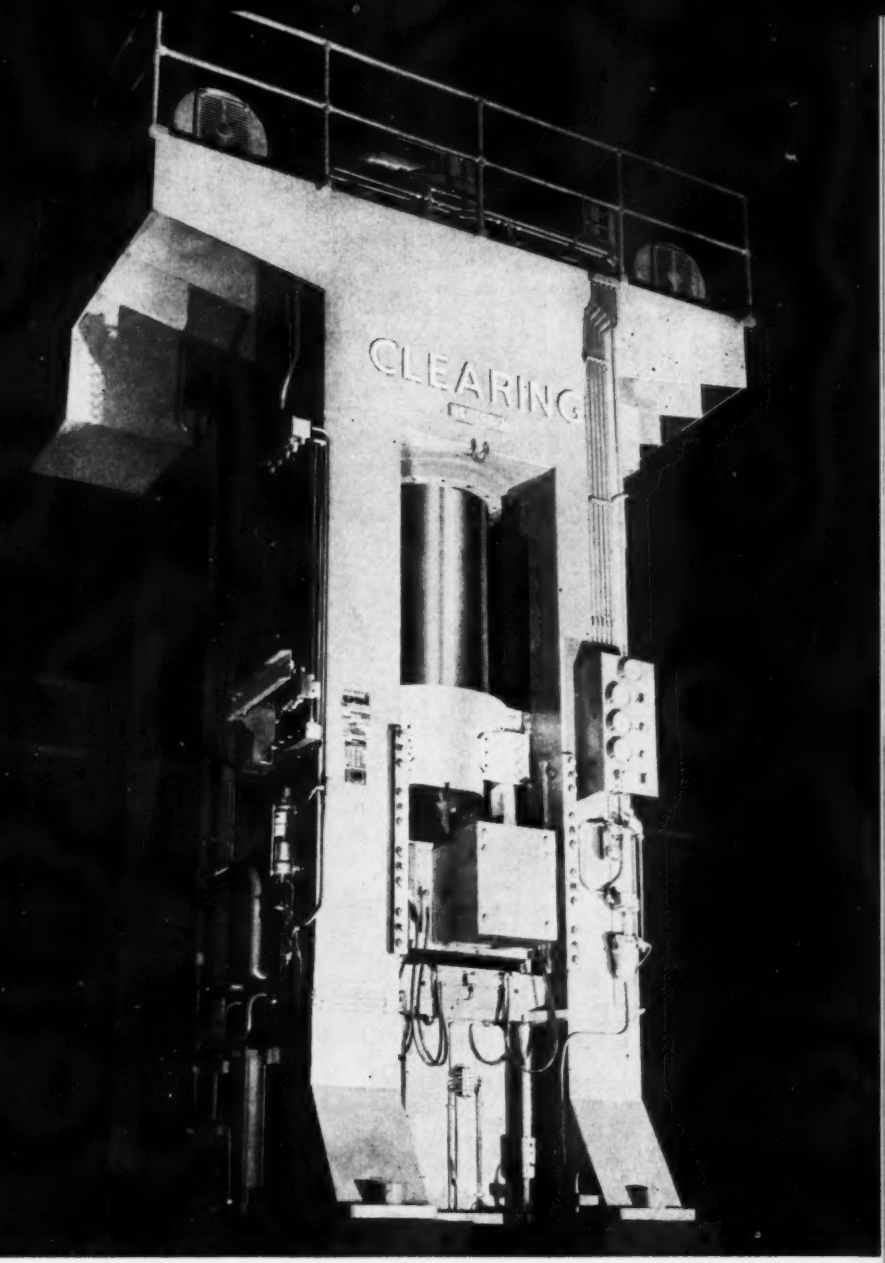

UNIFORM, PRECISE MOLDED PARTS WITH A CLEARING HYDRAULIC

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Personally Speaking...

Dear T & P Reader:

Have you been trying to hire anybody lately? If you have, you're probably wondering as I am just how unemployment figures come out as they do. All the figures I see, seem to indicate that the creation of new jobs is not at a high enough rate to cut the unemployment rolls appreciably, and yet it is extremely difficult to find people to hire that have sufficient competence to be satisfactory.

Our interest has been in female help for a couple of comparatively uncomplicated office jobs. We've interviewed great numbers that have come to us through newspaper advertisements as well as employment agencies. We've given all applicants easy tests which would measure the competence we might reasonably expect and it is utterly amazing how few are qualified.

My conclusion has to be that many of our employment figures are completely phony and utterly undependable and this of course leads to another line of thinking. Even though you personally may not have experienced marked gains in industrial activity there are numerous signs that we reached the "bottom of the valley" in the very early months of this year. The signs that are present now, many prognosticators feel, indicate that general business will be hitting boom proportions by the middle of 1962.

The realization of this leads to another question. Will your plant's productivity be adequate to meet the demand for the goods you manufacture? If you can't get competent people to get maximum productivity from the machines you now have then there is only one thing left to do, and that is to get machines that are more productive.

This leads to another question, what should I replace and when? Issue by issue this year, we have unfolded a series of articles which give guidance on when and under what circumstances production machines should be replaced. If you haven't kept the series but would like it complete in one piece, we're going to make this available soon. Watch for announcements in this or later copies of Tooling & Production.

Cordially yours,

Ray Huebner

Publisher

In snow or mire, they reach the fire

FWD Fire Engines feature power and traction on all four wheels to assure maximum fire-fighting reliability . . . they go where the fire is.

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V-R

FIRST CHOICE of more and more plants

C-859

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No. 3 Moore Jig Grinder at Wauconda with the slot-grinding attachment in position. Accessories like these bring out the full versatility of Moore equipment and help solve "impossible" jobs.

"Moore equipment enables us to produce millions of parts to exacting tolerances"

says Kenneth Pearson, Co-owner, Wauconda Tool & Engineering Co., Inc. Algonquin, Illinois.

"Specializing in out-of-the-ordinary, close-tolerance press and multi-slide work, it is essential for our plant to have the best toolroom equipment.

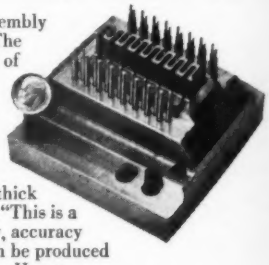
"Our Moore Jig Borers and Jig Grinders make it possible for us to do the unusual in the line of accuracy required for our precision die work and enable us to produce millions of parts to the exacting tolerances that are so essential in computer, missile, instrument and electronic components.

"These machine tools do the ordinary as well as the extraordinary, day in day out, and are in constant use. The rigidity, durability and precision built into Moore equipment makes them unequaled for our exacting requirements.

"We base our business on the premise that quality is remembered long after the price is forgotten. Moore equipment contributes in large measure to this quality."

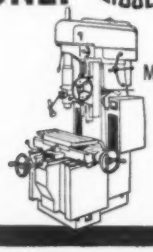
Write today for literature describing the unique features of No. 3 Moore Jig Borers and Jig Grinders.

Moore Special Tool Company, Inc.,
726 Union Avenue, Bridgeport 7, Conn.

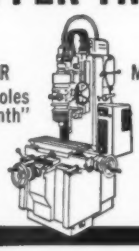


Contour grinding on a punch assembly for an intricate progressive die. The entire shaped contour, consisting of individual inserts, has been jig ground, with outside and inside radii ground in the assembled state and the straight portions ground as individual inserts. Note coin for comparative size. The stamping produced is .006" thick and must be absolutely burr free. "This is a good illustration of the versatility, accuracy and high degree of finish that can be produced on Moore equipment," says Henry Harper, Co-owner of Wauconda Tool & Engineering Co., Inc.

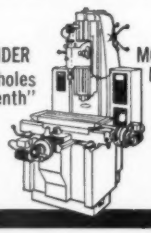
ONLY MOORE TOOLS CAN OFFER THIS COMPLETE PACKAGE OF PRECISION



MOORE No. 3 JIG BORER
Locates and bores holes to less than a "tenth"



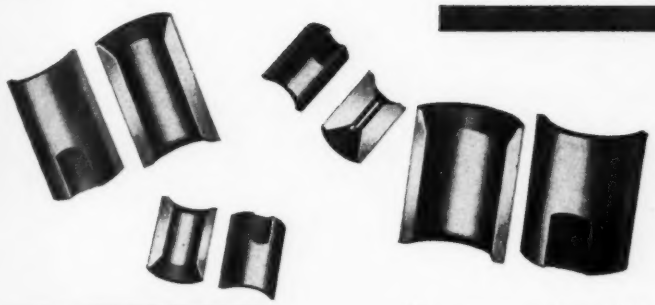
MOORE No. 3 JIG GRINDER
Locates and grinds holes to less than a "tenth"



MOORE UNIVERSAL MEASURING MACHINE
Measures to one-third of a "tenth"

MOORE ROTARY TABLE
Divides the circle to less than 2 sec.

CIRCLE INFORM-A-GRAM KEY NO. 6



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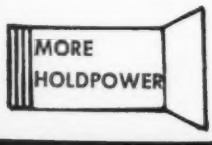

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Cleveland 14, Ohio

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4 Burgmasters

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1500 parts programmed in tape.....

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6 Spindle
¾" Drill & Tap Capacity in Steel
Table Travel 15" x 20"

Model 2SAHT
6-spindle,
1¼" capacity in steel. Table travel 15x25, 20x30, 30x45.

Model 5BHT
8-spindle, 1½" capacity in steel. Table travel 20x30, 30x45.

Model 5B
Double
Planer
8-spindle
1½" c
steel. Tab
48x60.

PAYS FOR 4 MACHINES IN 1 YEAR

aves $150,000
n Tooling Costs

* Collins Radio Company, Cedar Rapids, Iowa.

ne Operator Controls Two Machines

At Collins Radio Company, Cedar Rapids, Iowa, approximately 1500 tapes have been prepared for use with the four Burgmaster Model 2BHT Tape-Controlled Turret Drills which they have in operation. Collins figures the difference saved between a tape and a conventional drill jig is $100.00, or a savings of $150,000.00 to date. This is in addition to the thousands of dollars saved in increased production, elimination of handling time, rejects, scrap and floor space. Another major savings innovation is Collins' assignment of a single operator to control two Burgmaster machines.

To the extreme left, 4 Burgmaster Turret Drilling Machines are being operated by only two men. Units #1 and #2 are banked at right angles for operator #1, and Units #3 and #4 are banked at right angles for operator #2.

Left, operator checks progress of Burgmaster Unit #2 as Burgmaster Unit #1 starts its pre-programmed cycle of machining operations.

CIRCLE INFORM-A-GRAM KEY NO. 9

World's Largest Builder of Turret Drilling Machines

"0" Manual Power Index ¼" Capacity

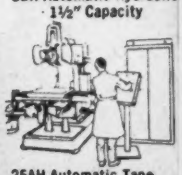
1C Manual Power Index ⅜" Capacity

2B Manual Power Index ¾" Capacity

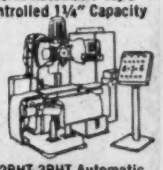
2BR Ram Type Radial Drill ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity



25AH Automatic Tape Controlled 1¼" Capacity



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Write for bulletin describing Burgmaster 6 and 8 Station Tape Controlled Turret Drilling, Tapping and Boring Machines. Forty minute 16 mm sound film showing all Burgmaster Turret Drills in operation is available without charge from any office.

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4 Burgmasters

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1500 parts programmed in tape.....on

Model 2BHT-L
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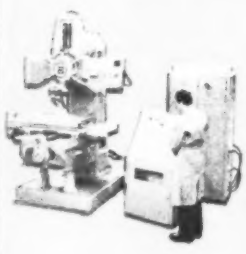
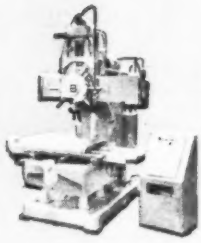
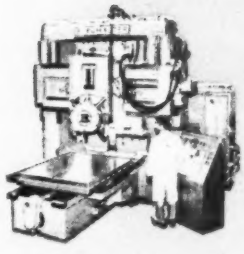
¾" Drill & Tap Capacity in Steel
Table Travel 15" x 20"



Model 25AHT
6-spindle,
1¼" capacity in steel. Table travel 15 x 26, 20 x 30, 30 x 45.



Model 3BHT
8-spindle, 1½" capacity in steel. Table travel 20 x 30, 30 x 45.



Model 3BHT-B Double Housing Planer Type
8-spindle,
1½" capacity in steel. Table travel 48 x 60.

PAYS FOR 4 MACHINES IN 1 YEAR

Saves $150,000 in Tooling Costs

Collins Radio Company, Cedar Rapids, Iowa,

World's Largest Builder of Turret Drilling Machines

....One Operator Controls Two Machines

At Collins Radio Company, Cedar Rapids, Iowa, approximately 1500 tapes have been prepared for use with the four Burgmaster Model 2BHT Tape-Controlled Turret Drills which they have in operation. Collins figures the difference saved between a tape and a conventional drill jig is $100.00, or a savings of $150,000.00 to date. This is in addition to the thousands of dollars saved in increased production, elimination of handling time, rejects, scrap and floor space. Another major savings innovation is Collins' assignment of a single operator to control two Burgmaster machines.

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Left, operator checks progress of Burgmaster Unit #2 as Burgmaster Unit #1 starts its pre-programmed cycle of machining operations.

"D" Manual Power Index 14" Capacity

1C Manual Power Index 36" Capacity

2B Manual Power Index 24" Capacity

2BR Ram Type Radial Drill 24" Capacity

2BH Automatic Hydraulic 24" Capacity

3BH Automatic Hydraulic 13½" Capacity

25AH Automatic Tape Controlled 11¼" Capacity

2BHT-3BHT Automatic Tape Controlled 24" and 13½" Capacity

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TRANSISTORIZED SENSOMATIC CONTROL SAVES MAN HOURS, PREVENTS MATERIAL WASTE, MACHINE AND TOOL DAMAGE

Newark, N. J.: A new line of transistorized controls called Sensomatic has been developed by Weldotron Corporation. Sensomatic is a low-cost, easy-to-install digital control for monitoring automatic machine operations. It will stop the machine immediately upon detecting malfunctions such as misfeed, improper positioning or improper parts transfer, buckling, end of material, etc., thus preventing tool and machine damage and material waste. Add to this the savings in man-hours and the fact that faster operation is possible because it reacts quickly, and it is easy to see why Sensomatic will surely cut costs in your automatic machine operations.

Sensomatic is ruggedly constructed with no moving parts in operation. It requires little power and features fail-safe, dust free circuitry encapsulated in epoxy resin for maximum resistance to shock, moisture and other detrimental environmental conditions.

Proven performance

For some time many large manufacturing companies such as Scovill Mfg. have been using Sensomatic units in actual production operations. Records have proven the success of the units.

Sensomatic controls are available in several models. To learn which model is best suited to your operations, please write today to Weldotron Corporation, 911 Frelinghuysen Avenue, Newark 14. N. J.

SENSOMATIC Model 1200 Will Monitor Operations of up to 12 Stations

The Sensomatic 1200 Multi-Station Detector will monitor operations of up to 12 stations. If a malfunction occurs at any one station, the machine is instantly stopped and a visual signal alerts the supervisor. The exact location of the trouble is pinpointed by individual indicator lights.

The 1200 is supplied with 4 modules but eight others may be added as requirements increase. Economical use of the modules is possible because they are interchangeable on all Model 1200's.

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in the production of the
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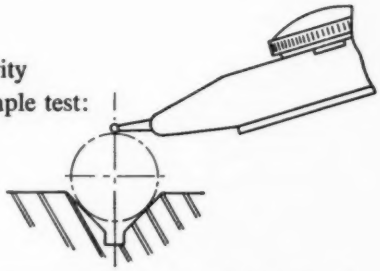
(Above)
Super-Sensitive Testmaster Model LT-½. Large Dial. .008" range, .00005" min. grad.

PROVE this superiority with this simple test:



(Below)
Super-Sensitive Testmaster Model T-2. Regular Dial. .008" range, .0001" min. grad. (Large Dial: Model LT-2). Metric Model also available.

Support, in a V block or on centers, a part which is out-of-round in the order of .0002". Mount the new Federal T-2 or LT-2 Testmaster beside any other test indicator having .0001" grads. Then rotate part carefully and compare readings. You'll be surprised to see how much more smoothly the new Testmaster responds — how much more accurately it shows the actual variation in dimension.

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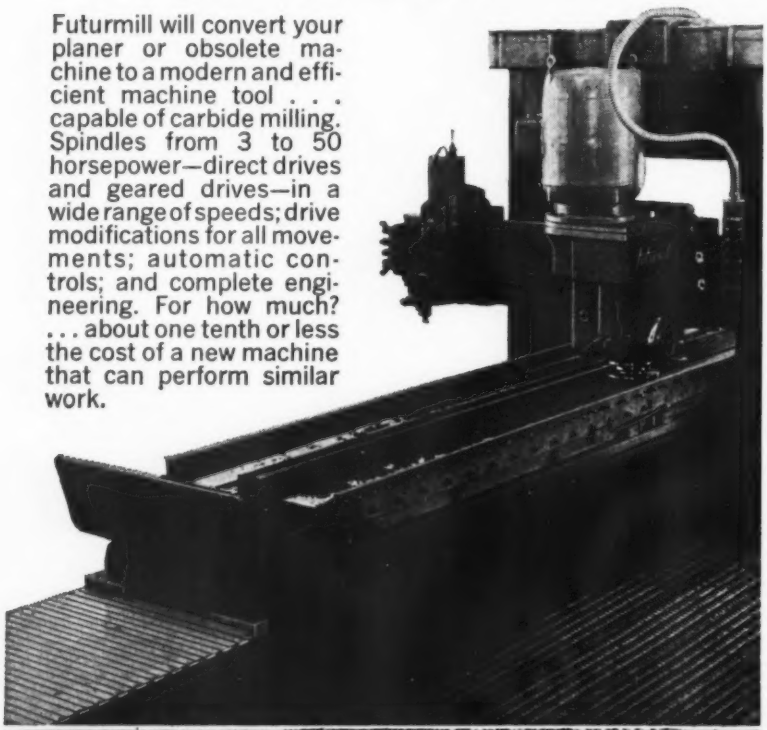

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CIRCLE INFORM-A-GRAM KEY NO. 14

Talk of the Month

Ideas Through Pyramiding

by C. W. Gardner

This presentation was excerpted from a talk given by Mr. Gardner, of Manufacturing Development, General Motors Corp., at a recent gathering of the Society of Automotive Engineers.

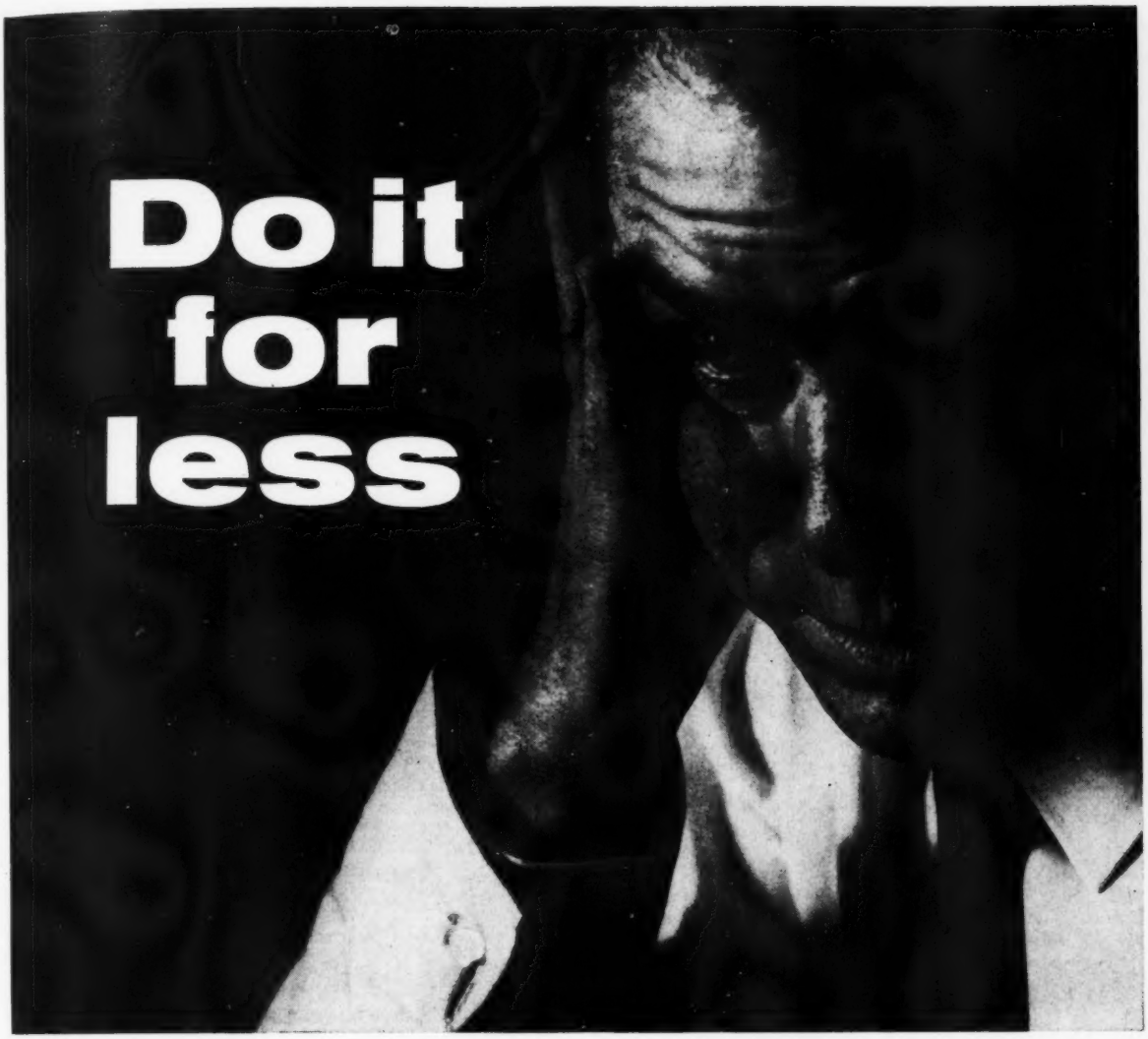
SINCE THE TITLE of my subject includes the word, "pyramiding", it is desirable that we start with a common understanding of what I mean by this term.

The dictionary definition is of little value since our use has nothing to do with Cheops' monument at Gizeh, nor a geometrical figure. Perhaps the closest approach to a definition is the one applied to a certain type of stock market manipulation wherein, by use of good judgment, small investments are made to produce large returns. If in this definition you replace the monetary terms with ideas that are then combined, refined and recombined until the result is of greater value than any one of the original individual ideas, you have obtained the desired objective by a technique which we, at Manufacturing Development, call "pyramiding."

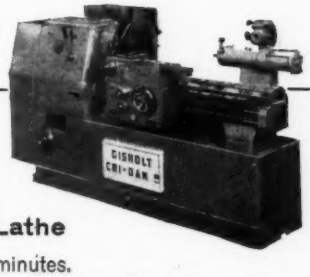
For example, suppose that a problem has arisen due to an unpredicted cost increase in the material used to make a certain critical part in an electric motor. This cost increase, if not offset by a more economical manufacturing method, will lessen the manufacturer's ability to meet competition.

What to do? Where do we get new ideas on this subject? Let's have a pyramiding session! Do we call Paul, the porter, Katie from the cafeteria, Joe, the janitor? No! We call the people whose experience makes them the most familiar with the problem involved. Their meeting will probably begin with the disclosure of an idea by one of them, and through discussions both

. . . . Continued on page 16



ON A CRI-DAN AUTOMATIC THREADING LATHE



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. . . Month's Talk from page 14

pro and con, the combining of the know-how of all. It is a way of adding together the best knowledge of all the group. This is "pyramiding."

Since this subject can be broad and time-consuming, I restrict my discussion to the problem solving technique used in the engineering activities of General Motors Manufacturing Development, and which can be applied by engineers in either design or manufacturing.

Why do we prefer this technique to some of the more semantically glamorous approaches such as brainstorming, operations research, Univac or linear programming, especially since brainstorming appears to be particularly applicable? According to the rules for brainstorming as originally laid down, a lack of specific knowledge about anything is a virtue.

In such a meeting, where anyone says anything that comes into his mind in answer to questions not directly connected with the problem to be solved, someone **may** have an applicable idea. But when this one idea is finally sifted out and sorted from the verbal debris left by this time-consuming operation, is there any guarantee that this is a **good** idea?

Not all ideas are good ideas. Sometimes it may take months of effort and the expenditure of large amounts of money to finally demonstrate that some seemingly insignificant factor is insurmountable. In many cases this little factor is perfectly discernible at the start but, like an iceberg, it does not show in its true proportions until it is struck head on.

Now, if on your brainstorming team you had had a person familiar with icebergs, or those seemingly insignificant factors, and he had been allowed to speak up about them, the chances are you would or could have avoided the obstacle. But this is not the way a brainstorming session is supposed to work. In brainstorming there is no place for criticism.

This is our reason for using pyramiding rather than brainstorming. We must have ideas that are based on logical, solid mechanical principles, tempered by experience, that will indicate the possible degree of success before any action is taken. Many of the perplexing problems with which we are continually faced are tied closely to an important manufacturing problem that has a completion date that will allow few fake starts or failures.

A sound, intelligent question asked of a competent and skilled person is likely to produce useful information. That is why we feel that in pyramiding with a group of competent people with plenty of know-how, with the freedom to make suggestions and to criticize, we have as much advantage over the brainstormers as a scientist with his seismograph has over the fakir with his divining rod. I have read a report on an actual pyramiding session, the product of which has been in production for several years. It follows: (The "I" in the text is the person of the report writer.)

Some years ago we desired to reduce cost and improve quality

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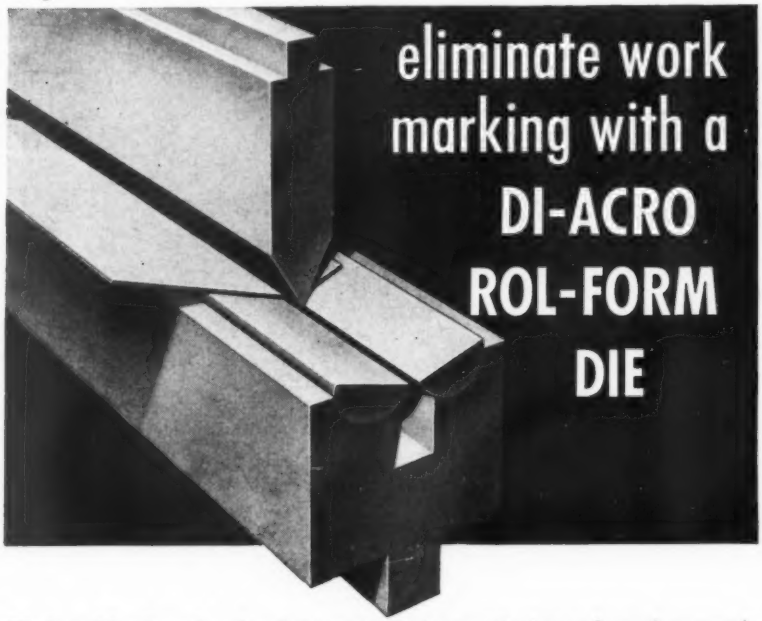

Workmarking from forming sheet materials in press brakes and punch presses is greatly reduced and in many metals completely eliminated when formed with the Di-Acro Rol-Form Die. Hardened and Precision ground rolls pivot smoothly in the die block to fold material without strain. You save costs by discarding elaborate and time consuming preparation and work methods, reducing polishing time, eliminating scrap parts. You also cut costs in press brakes and punch presses by reducing the number of dies needed and reducing set-up time.

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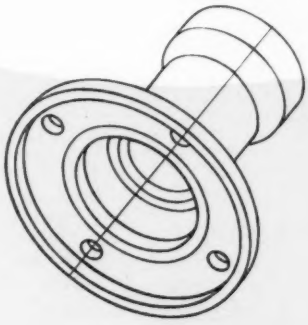

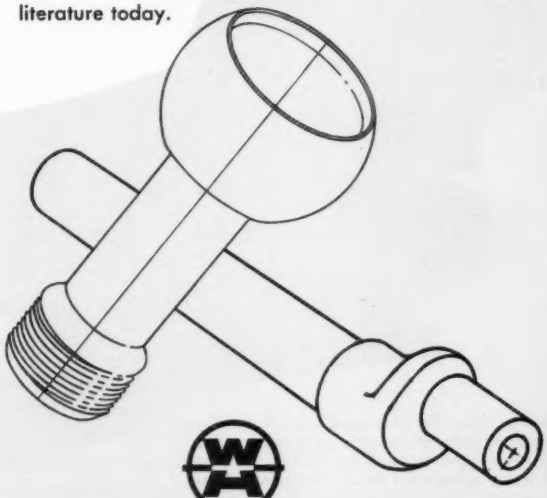

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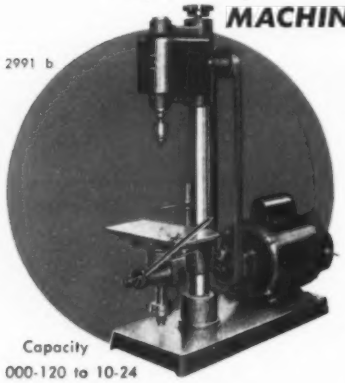
CIRCLE INFORM-A-GRAM KEY NO. 17

HAMILTON SUPER SENSITIVE
Tapping
MACHINE



Spindle does not rotate between duty cycles but starts cutting rotation softly and slowly as pressure is applied to the feed lever. Further, rotation stops instantly and automatically when pressure on the feed lever is released; and reverses when pressure is reversed.

As a result of this unique feature, blind holes now can be tapped to the very bottom without risk of tap breakage, thin materials can be precision tapped without stripping, brittle materials can be tapped without chipping.

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A super sensitive, small hole, precision drilling machine which offers infinitely variable speeds in two ranges between 840 and 9300 R.P.M. A true "companion" to the HAMILTON Super Sensitive Tapping MACHINE. Capacity — .004" to 5/16" in all drillable materials.

For complete information ask us for our free Bulletin No. V/14.

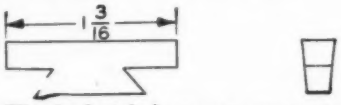
THE HAMILTON TOOL COMPANY

832 SOUTH NINTH STREET
HAMILTON, OHIO
CIRCLE INFORM-A-GRAM KEY NO. 18

. . . **Month's Talk from page 16**

of generator armature commutators. There were 23 copper bars in each commutator shaped like this:

They were blanked from bars of drawn or rolled stock, and there was a slug lost from each bar:

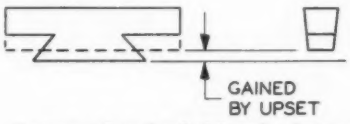


We had tried many ways to make this bar from round wire, a much lower cost material.

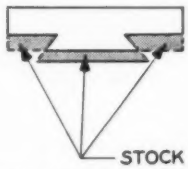
I had an idea I thought was pretty good. I was so enthusiastic that I at once called several people to my office to describe the process.

I called only those who were technically capable of appreciating the idea. I wanted the approval of my peers. I was going to start with a round wire and draw it to a keystone shape, thus:

Actually, the height of the keystone would be less than the finished bar:

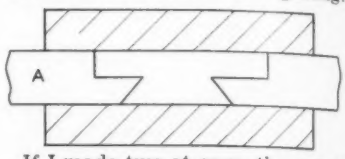


I planned to feed this wire into a cold header and upset it to form the dovetails:

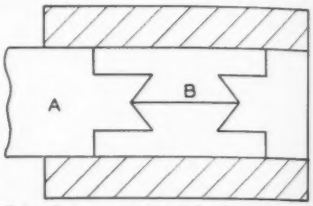


I would have a bar with no loss of material, and made from very low cost copper. I showed the sketches to my fellow experts and invited their comments, which I felt certain would be highly complimentary. The first comment was a question. How many was I going to make at one stroke of the press? This was irritating, and I got a little sarcastic—remarking that I saw no reason to complicate the process by trying to double up. With patience and pleasure, he explained that it was doubtful if the process would work making one at a time. He gave this reason:

He said that the wedging force in the punch A would drive it so hard against the die wall that I would have trouble with galling:

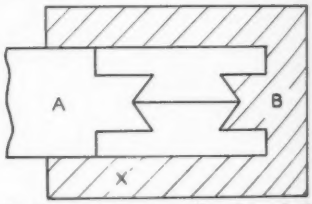


If I made two at once, the punch would be balanced and would float without excess side wall pressure. Also, as a unique feature, the surfaces at B would mutually support each other and need no die wall.



I had to accept this because the tooling was no more complicated and the production of the cold upsetter was doubled.

The next comment was another question. Was the die to be fixed, or would it float? In other words, would the punch at the bottom of the die have a fixed relation to the die? It certainly seemed as though that was the simpler construction and I saw no reason to complicate it. He suggested that it would be better to **make the die more complicated** if it would make it workable:



If X and B are fixed and the movable punch has the duty of forming its dovetails and also pushing the piece onto punch B to form dovetails in the other end, it would do a uniform job only if the movement of the pieces in the die was frictionless. Any pressure on the side walls would induce friction which would subtract from the available pressure to upset the dovetails at "B."

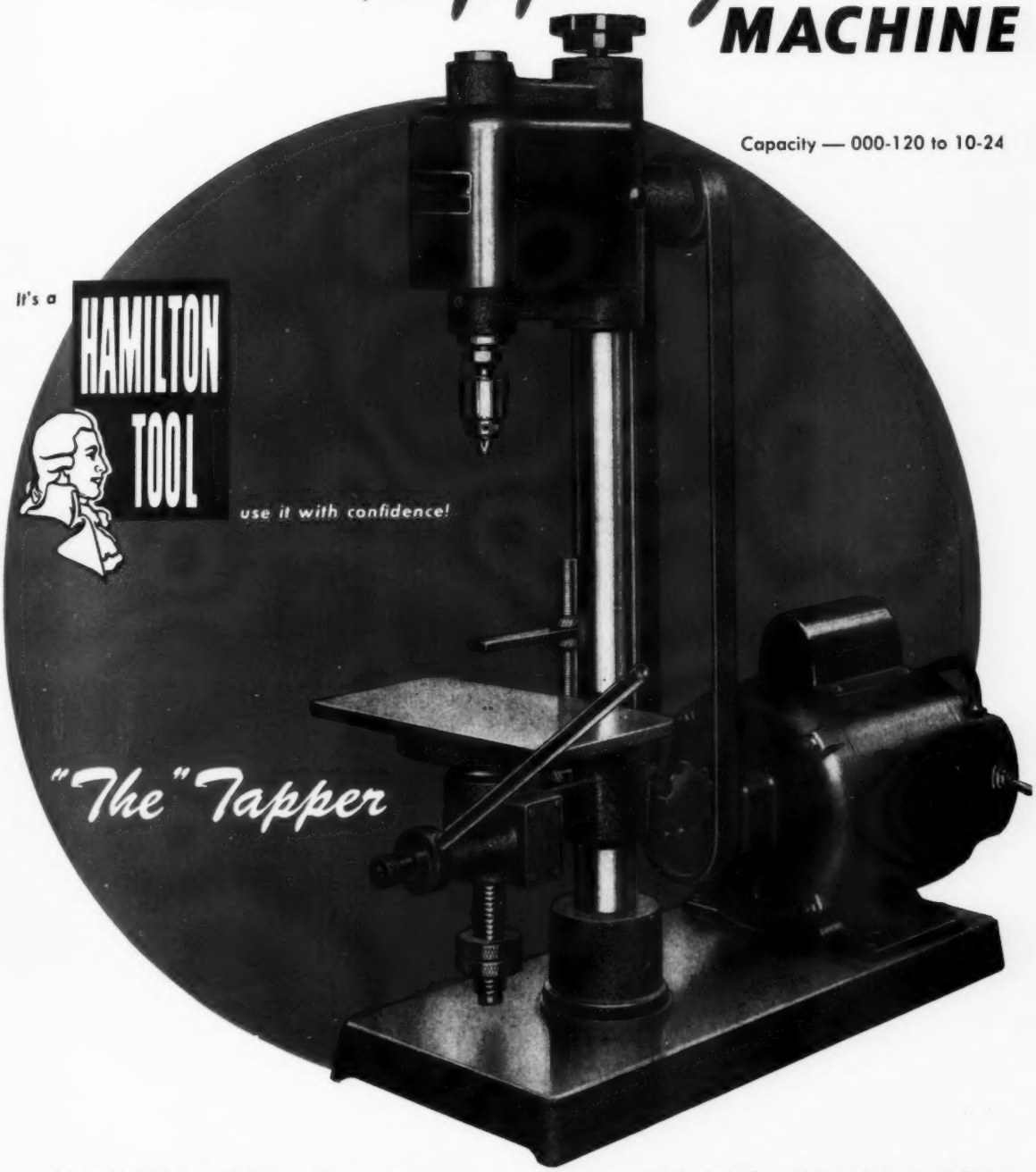
If the die floated—had possible movement in the direction of punch movement, any friction effect

. . . **Continued on page 20**

2991 a

HAMILTON SUPER SENSITIVE Tapping MACHINE

Capacity — 000-120 to 10-24



In the field of small hole, precision tapping the HAMILTON Super Sensitive Tapping MACHINE stands alone. It is smooth, silent, precise, and sturdy.

Spindle returns to neutral position and stops rotation instantly and automatically when pressure on the feed lever is released.

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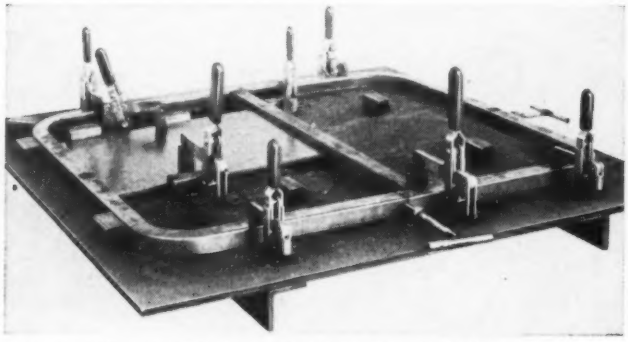

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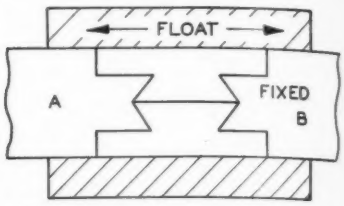
CIRCLE INFORM-A-GRAM KEY NO. 20

. . . Month's Talk from page 18

would cause the die to move with the piece, permitting the full force on "A" to be applied on "B":



The "pyramid" was built and the process was a success. I no longer had an idea. **WE** had one. ■

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A growing volume in Hydrospinning work, largely in the missile field, has led Avco Corp.'s Lycoming Div. to install a large vertical Cincinnati Hydrospin machine.

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The horizontal machine, specially adapted to accommodate parts up to 60" dia, has been working at the Stratford, Conn., facility since 1954. Its missile projects include: Nike-Hercules, Bullpup, Minuteman, Polaris, Talos, Titan-Atlas, and Saturn.

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You get all the advanced-design features of the production-proved P 400 Fellows-Pfauter hobbing machine — plus extra work capacity — with the new Model P 630. Takes work up to a diameter of 25″. Maximum face width at 25″ diameter is 16¼″. Maximum diametral pitch in steel is 3. It's fast, easy-to-handle . . . and it's built for high production.

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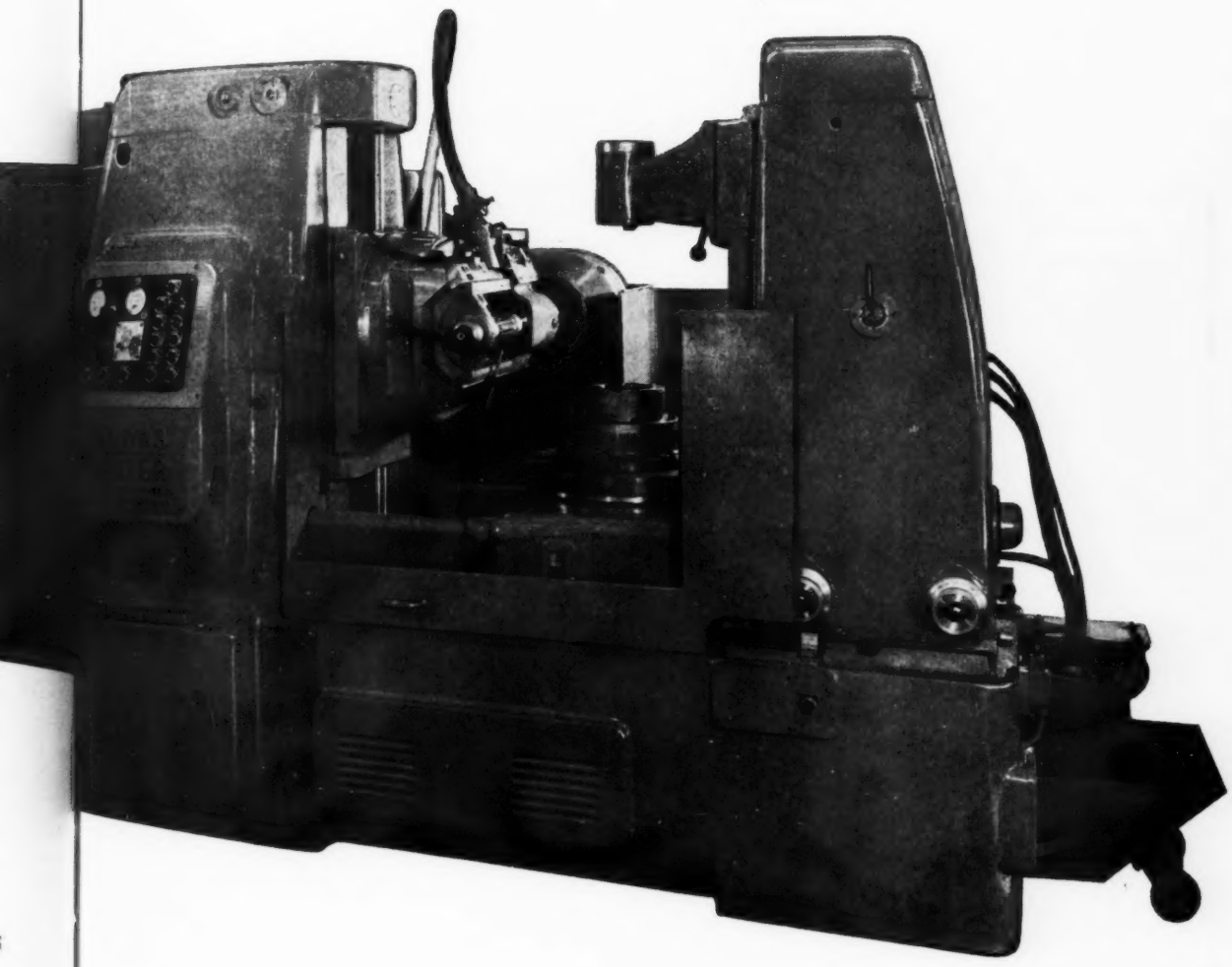

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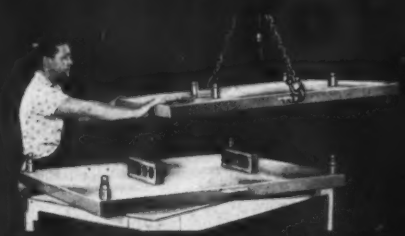
Now on all SUPERIOR die sets in diameters from 1½" upward at no additional cost.

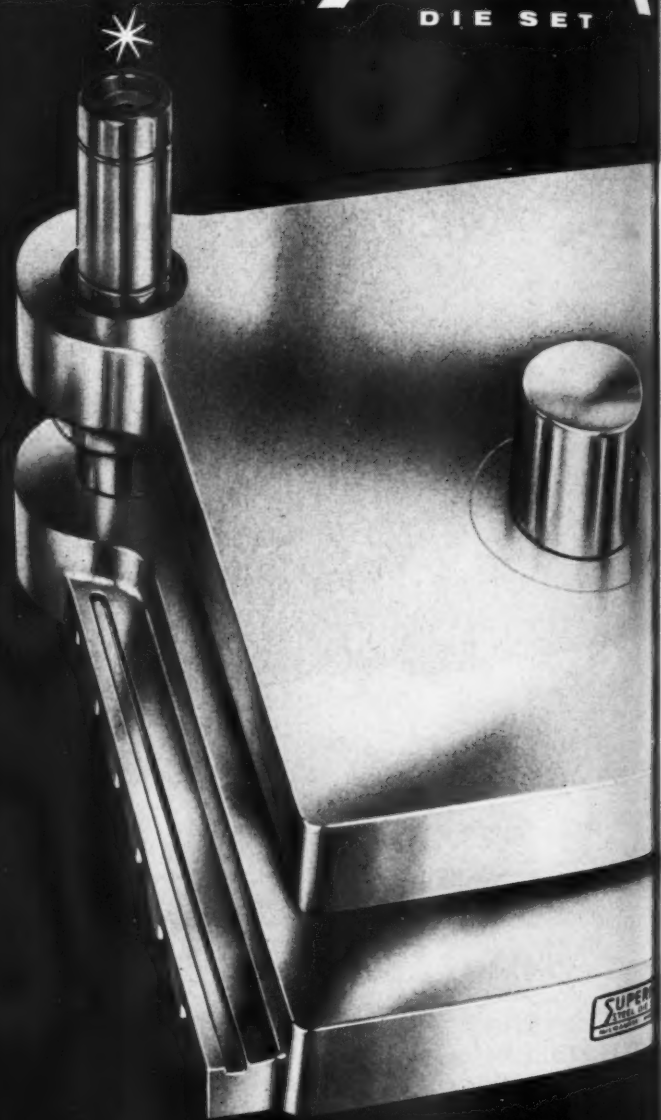


One man parts large die set in a few minutes with Superior Removable Cap Guide Pins.

No Die Set Smash-Ups
Should foreign matter cause pin and bushing seizure, the socket screw pulls out of retaining washer . . . then the matching taper of pin and cap act as guide to prevent costly die damage.

WRITE FOR CATALOG

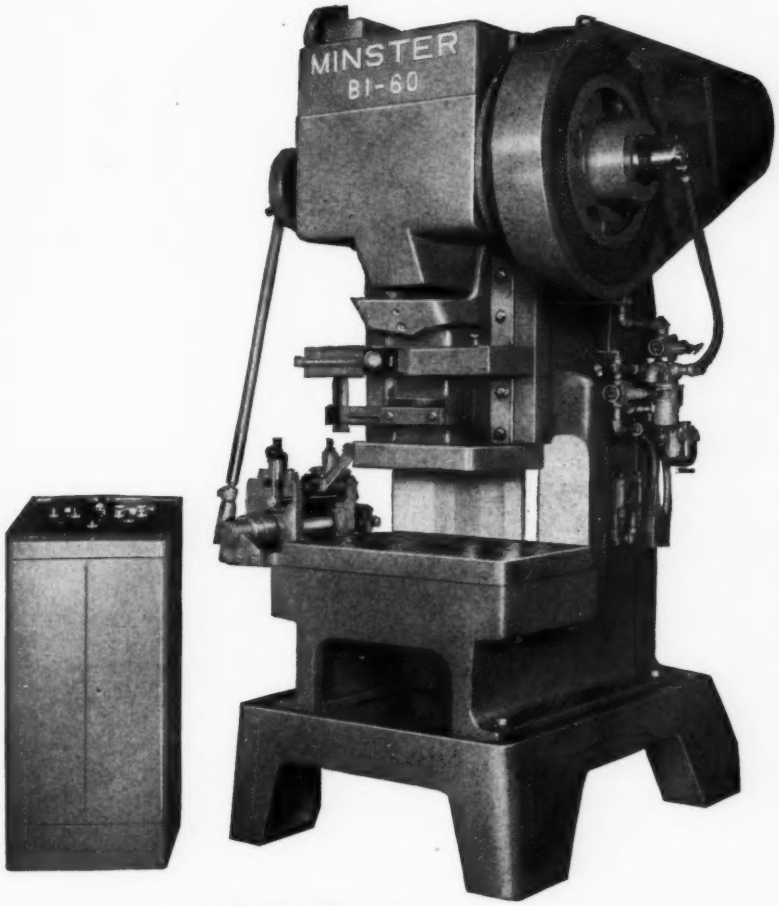
THE *Exclusive* SET



SUPERIOR DIE SET CORP.

2754 South 19th Street · Milwaukee, Wisconsin
Cheshire, Connecticut

If you make small parts in large volume....
this B1 press will make them faster,
more accurately and at lower cost per part.



CONSIDER IT!

Improvements in tooling and production technology have led to higher speeds, more intricate dies and multi-stage operations. Minster anticipated the industry's need for a press specifically designed for high speed, small parts stamping. We were best prepared to develop such a press. Minster B1 presses have greater stability, precision and rigidity to do the job. Capacity range is 16 to 60 tons . . . proper feed equipment available to match your job. Ask a Minster representative to show you why a B1 press is superior.

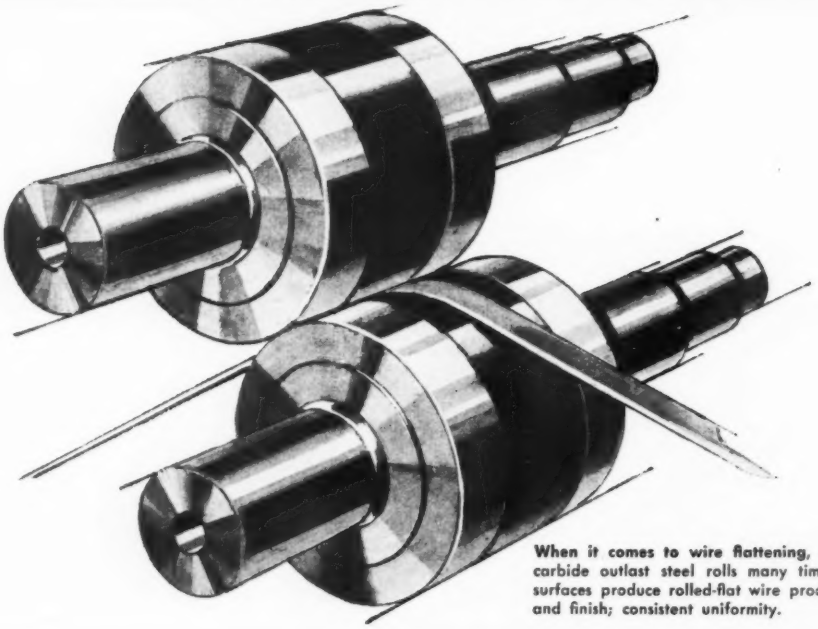
The Minster Machine Company, Minster Ohio

MINSTER®

CIRCLE INFORM-A-GRAM KEY NO. 24

CIRCLE INFORM-A-GRAM KEY NO. 25

"MOVING METAL" with Carboloy® Cemented Carbides

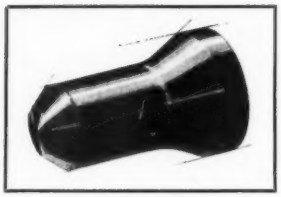


When it comes to wire flattening, rolls of Carboloy cemented carbide outlast steel rolls many times. Smooth, wave-free roll surfaces produce rolled-flat wire products of exceptional quality and finish; consistent uniformity.

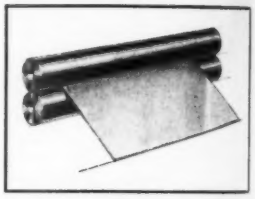
Reduce costs, save machining time with Carboloy® cemented carbides

How efficiently you "*move metal*" from one shape to another depends on the quality, accuracy and uniformity of the carbide you use. General Electric Carboloy carbides for coining and extruding punches, wire-flattening and sheet metal rolls are designed to do the job better, in less time, at lower cost, with less metal waste.

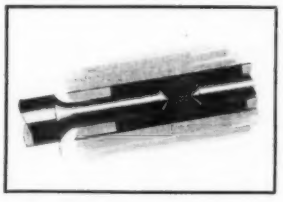
Continuing research by General Electric's metallurgists and technicians results in carbides of highest quality and uniformity — dependability for the job at hand. Call your Carboloy Die Distributor or Die Maker to help you "*move metal*" at lower cost. Or write: *Metallurgical Products Department of General Electric Company, 11111 E. 8 Mile Avenue, Detroit 32, Michigan.*



Cold extrusion punches made of G-E carbides find a wide variety of applications. For example, in the production of bearings, a solid carbide punch forms a race and cup from one steel slug—minimum waste; saves machining.



You get uniform, more even sheet when you use rolls of Carboloy cemented carbides. Roll structure is uniform throughout; excellent for working stainless steel. Carboloy rolls last longer and do jobs not possible with steel rolls.



From solid slug to wrist pin—2,000 an hour! Increased production is but one of the advantages when you use extruding and coining punches of Carboloy cemented carbides. You get uniform weight, surface finish, improved strength in the part produced.

CARBOLOY®
CEMENTED CARBIDES

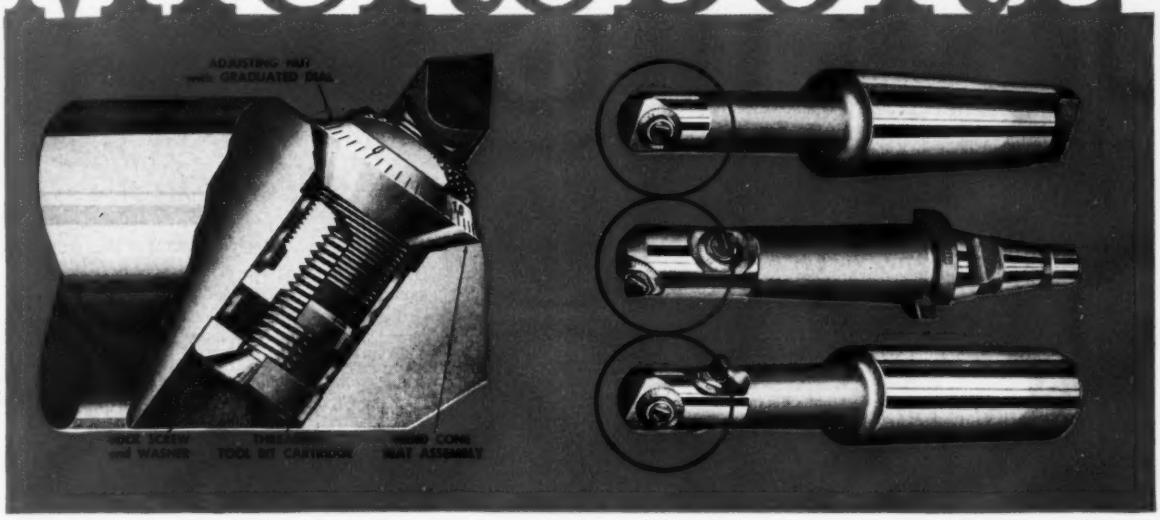
METALLURGICAL PRODUCTS DEPARTMENT
GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMOND • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

CIRCLE INFORM-A-GRAM KEY NO. 26

the precision
cutting tool system
with built-in
micrometer vernier
adjustment

MICROBORE®



Patented micrometer vernier adjustment! That's the exclusive feature that makes DeVlieg MICROBORE cutting tools so fast and easy to set. It's the built-in feature that eliminates trial and error cuts; reduces machine downtime and rejects. Micrometer vernier adjustment is also the feature that makes it easy to achieve accuracies impossible or extremely difficult to arrive at with conventional tooling. But that's only part of the story! Write for complete information on MICROBORE. Introduce yourself to a system of multipurpose tooling designed to deliver the utmost in precision and production from today's high performance machine tools.

DEVLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY • FAIR STREET • ROYAL OAK, MICHIGAN

MICROBORE • PRECISION TOOLING CENTER

DEVLIEG MICROBORE SYSTEM

CIRCLE INFORM-A-GRAM KEY NO. 27

UNIVERSAL BORING CHUCK is heavy and rigid for all types of rough boring without chatter yet accuracy of adjustment adapts it equally well to finish boring. Time-tested Universal Collet nose holds boring tool much more rigidly and securely than set screws while precision and extreme accuracy of feed-adjustment are obtained by an anti-backlash arrangement of feed screw and large dial.

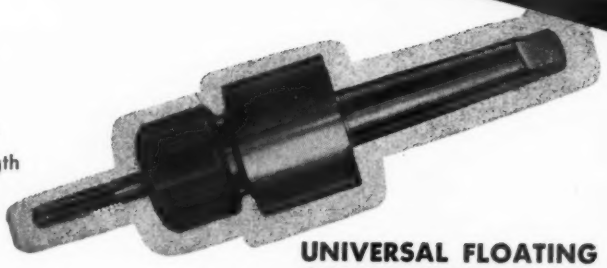
UNIVERSAL
COLLET CHUCKS

combine maximum holding power and minimum run out with simplicity of design and low price

The basic collet principle is the same in all Universal chucks. Tools gripped in these chucks withstand a maximum thrust and radial load because the collet grips on a continuous surface its full length and positively locks the tool. Write today for new catalog showing the complete line of Universal collets and chucks.

UNIVERSAL RELEASING TAP CHUCK has same basic collet principle featured in all Universal Collet Chucks. Screws or sleeves are not needed and collets are interchangeable with other Universal chucks. Simple, compact design has no springs, cams or pawls to break or wear. Can be used for either right or left hand tapping without adjustment.

HIGH PRESSURE REVOLVING COOLANT TRANSFER CHUCK has standard Universal Collet Chuck nose and a variety of shank sizes can be held by simply changing collets. Minimum overhang is made possible by the single face seal design. Back pressure principle of this design prevents "brake" action thus lowering torque on spindles. Chucks for higher speed and pressures than standard plus a variety of mountings are also available.



UNIVERSAL FLOATING COLLET CHUCK for horizontal or vertical operation is positively protected against destructive action of coolant by a seal which prevents entrance of compounds into interior of assembly. Frictionless ball bearing flat springs are adjustable to counter-balance weight of the tool.

210

UNIVERSAL ENGINEERING COMPANY FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 28

EDLUND MODEL NPB

PRINTED CIRCUIT BOARD DRILLING MACHINE

DRILL PRINTED CIRCUIT BOARDS FASTER, CHEAPER, AND MORE ACCURATELY

Now High Speed, Versatile, Tape Controlled Machine drills Printed Circuit Boards with amazing accuracy in a wide variety of material at low cost.

This High Production drilling machine is actually 16 drills in 1, it drills four boards or stacks of boards simultaneously, operating at 50 cycles per minute under average conditions. **Time Saving Versatility** is featured with 4 independent air feed units in each drilling cluster, each unit capable of carrying a different drill size and operating at spindle speeds up to 22,000 RPM. **The Tape Controlled point positioning** table and drill units assure maximum accuracy and reliability. Now drilling speed and size changes are done automatically, eliminating time consuming manual tooling and set-up.

Printed Circuit Boards Drilled on Edlund Machine

Edlund Model TPR Programmer for Tape

EDLUND PROGRAMMER PREPARES TAPE DIRECTLY FROM ART WORK

This unique Programmer prepares 1" 8-channel tape **DIRECTLY** from the draftsmen's art work at a **LOW INITIAL** and **LOW UPKEEP** cost.

ELIMINATE MASTER BOARDS and **SAVE** by preparing tape directly from art work. **HIGH SPEED PERFORMANCE** locates up to 30 positions per minute. **MAXIMUM ACCURACY AND RELIABILITY** are the result of the unique design which corrects errors in the art work and keeps the programming process on the desired grid automatically. **INDEPENDENT OPERATION** permits tapes to be prepared when drilling machine is in use. **COMPLETE VERSATILITY** is provided by precision interchangeable slides allowing the Programmer to handle grid sizes down to .025" including unusual grids.

Write for FREE Descriptive Bulletins

EDLUND
MACHINERY COMPANY
Division of Harsco Corporation Cortland, New York

Edlund Representatives in Major Cities CIRCLE INFORM-A-GRAM KEY NO. 29

875 DOLLARS

Buys this CLAUSING Vertical Miller

And look what you get!

1. **ACCURACY VERIFIED** to within TENTHS—
   - Spindle taper (internal) runout within .0002″ at spindle nose.
   - Spindle square with table, front to rear, within .001″ TIR in 5″ circle.
   - Top of table square with column ways within .0005″ in 6″ travel.
   - Table T-slots parallel to table dovetail ways within .0005″ in 8″ longitudinal travel.

   These and other tests showing exact indicator readings are on the report accompanying your machine.

2. **VERSATILITY**—The Clausing mills, drills, bores, reams, and shapes . . . at all angles . . . with one work set-up! It's perfect for general production, experimental, layout, and light jig-bore work.

3. **EFFICIENCY**—Users report that *"the Clausing is the easiest to set up, get around and operate of any mill . . . and it has sensitivity you don't get in larger machines—a mighty important factor when using small cutters."*

Make any comparison you want . . . We're sure you'll agree the CLAUSING vertical mill is truly an *outstanding* machine tool value! Write for a catalog today.

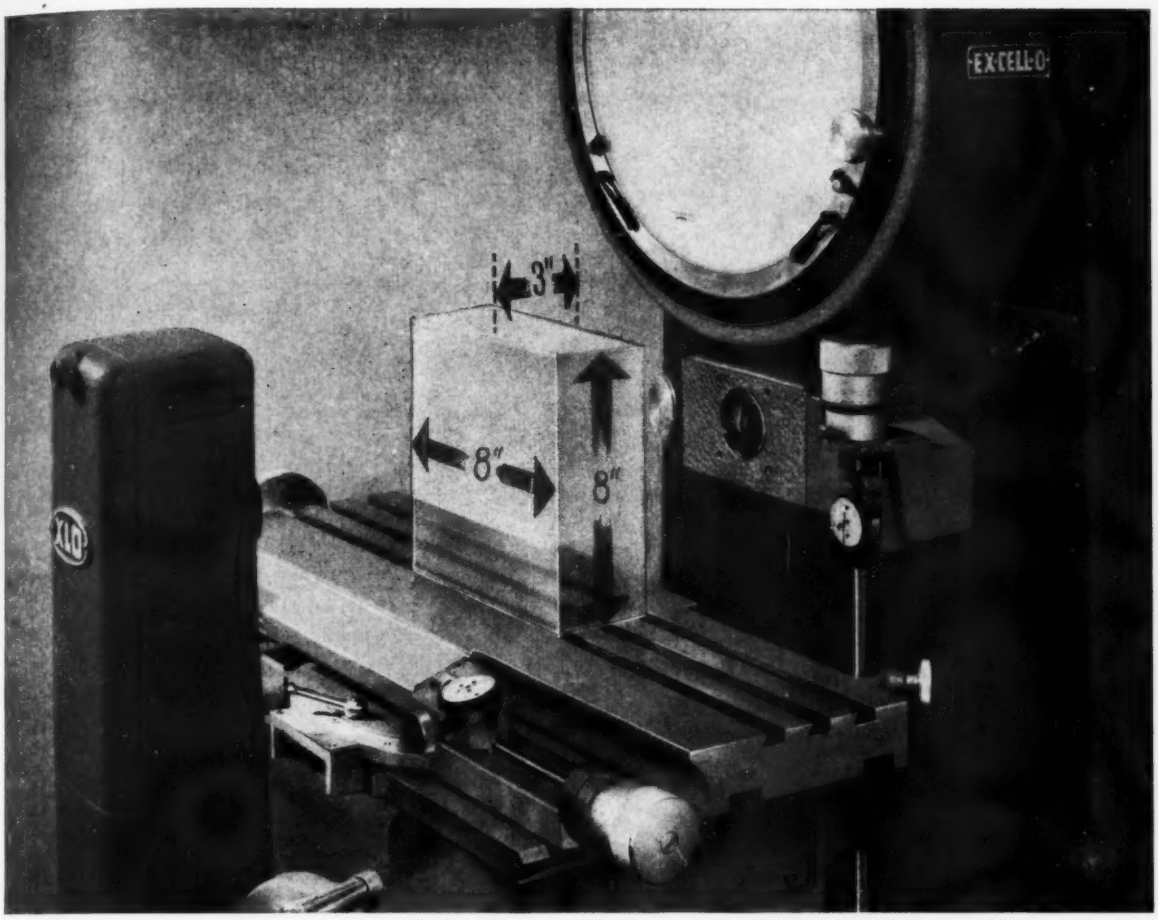
148

CLAUSING
DIVISION OF
ATLAS PRESS COMPANY

OUTSTANDING VALUES IN PRECISION MACHINES

10-118 N. PITCHER STREET, KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 30



EX-CELL-O Contour Projectors Give You 98% More Capacity

Ex-Cell-O Models 14-5 and 30 give you capacity to accept and optically gage much larger parts than is possible with other contour projectors,—*and without repositioning on the table!*

A full 8″ of table travel in both horizontal and vertical planes, together with 3″ of focusing travel is standard on these Ex-Cell-O Models. Every point within this "block" can easily be brought into focus on the screen.

Here is real capacity,—192 cubic inches,—98% *more* than the nearest standard model! Enables users to stage shafts 16″ in diameter, (and larger in some cases), and 16½″ in length on the standard work table with standard centers. Any point along the part contour can be optically gaged with convenient table movement.

"Cubage" isn't the only Ex-Cell-O capacity Plus! You get constant 8″ of working distance (lens to focal plane) —20% more than other standard projectors. Full 8″ of vertical measuring travel. Constant throat clearance, (collimator lens to front projection lens), of 17½″ on the Model 14-5; 16″ on the Model 30;—and Ex-Cell-O's rugged, heavy duty tables enable you to stage parts weighing up to several hundred pounds.

When you are ready to talk about Contour Projectors, compare feature for feature! There is an OGP Representative near you to demonstrate Ex-Cell-O's many PLUS values. Call or write. In the meantime, let us send you "43 Reasons Why EX-CELL-O Contour Projectors are the First Choice of Industry."

You Can Purchase Ex-Cell-O Contour Projectors on Conventional Terms . . . Deferred Payment Plan . . . or Lease With or Without Purchase Option. Select the Plan Best Suited to Your Needs.

Manufactured by EX-CELL-O Corporation at Detroit, Mich.

SOLD AND SERVICED BY

OPTICAL GAGING PRODUCTS, INC.

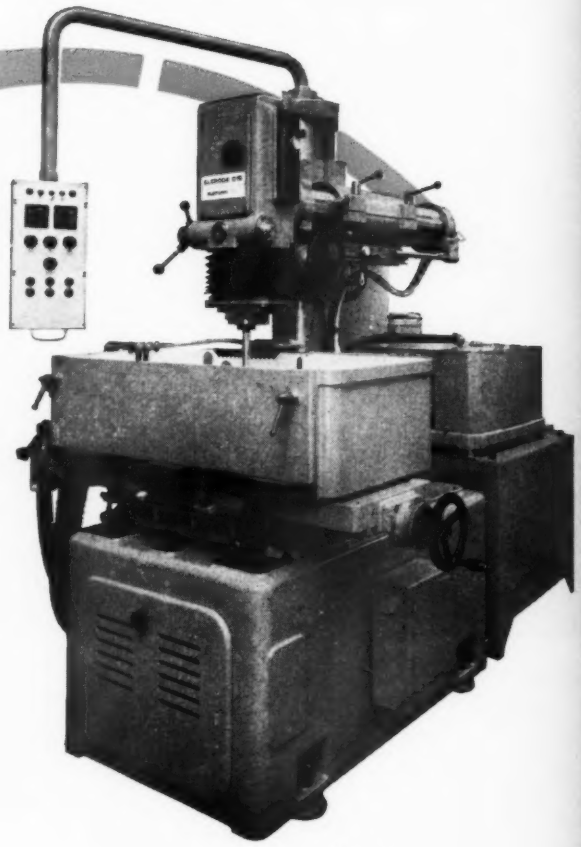
26 FORBES STREET ROCHESTER 11, N. Y.

(A subsidiary of EX-CELL-O Corporation)

CIRCLE INFORM-A-GRAM KEY NO. 31

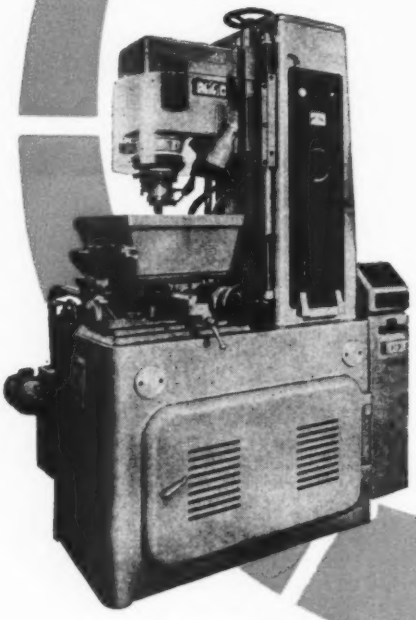
ELERODA D1 & D15

ELECTRICAL DISCHARGE MACHINES



D-15

High Speed: 15 cu. inches per hour.
Unique Versatility: Machines are tailored to fit user's applications.
Hydraulic Servo: Electric Impulse Generator (EPL-500)



D-1

An outstanding high precision erosion machine to work and locate with ± .0002". Surface Finish Guarantee 10 micro inches.

CHARMILLES

CHARMILLES ENGINEERING WORKS, LTD.
GENEVA, SWITZERLAND

Sales & Service Distributors:

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TRIPLEX MACHINE TOOL CORP.
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Oak Park, Ill. VIllage 8-1913

LOS ANGELES:
HAHN, HALLETT & WILLCUT MACHINERY CORP.
3620 Santa Fe Ave.
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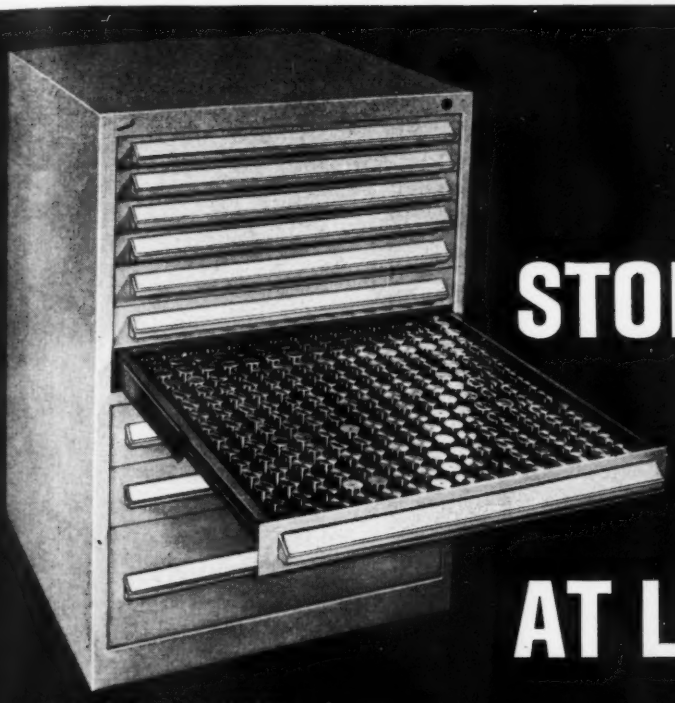
CIRCLE INFORM-A-GRAM KEY NO. 32



STORE MORE, BETTER, AT LESS COST

THIS CABINET HOLDS THE ANSWER to efficient, time-saving, cost-cutting storage of parts, tools, instruments, accessories and sub-assemblies . . . because . . .

SPACE IS USED TO THE MAXIMUM. Drawers can be divided into unlimited arrangements, as small as 1½" x 1½"—or larger, right up to the full 25" x 25" drawer size. And if your requirements permit . . .

A VIDMAR INSTALLATION LIKE THIS will store more, better, in less space than any other storage system available. Vidmar cabinets are designed and built expressly for industry . . . eliminate "waiting time", dirt, breakage and pilferage.

You can start your Vidmar facility with one or more cabinets. All units are modular in design—can be arranged, re-arranged, and added-to as required. Drawers are interchangeable within each cabinet or other Vidmar cabinets, and a specially designed and constructed suspension and extension system assures strength and stability. Drawers hold up to 400 lbs. each, without sagging, even when fully loaded.

Before you revise or add to your storage facilities, or plan the storage in new construction, it will pay you to look into the time- and money-saving advantages of Vidmar. Write today: Vidmar, Inc., 2326 Reach Rd., Williamsport, Pa.

Vidmar CABINETS Division of Volkert Stampings, Inc.

CIRCLE INFORM-A-GRAM KEY NO. 33

INGERSOLL'S NEW BLADE BACK-UP SERVICE

Provides individualized attention, adequate assured supply, maximum performance at minimum costs. If your company uses milling cutters and blades, either the "Grind" or the "No-Grind" type, you should know about the first full-range approach, by any qualified source, to lower blade and cutter costs and to improve tooling performance. It provides service and attention superior to that available from any other blade source.

What the Ingersoll Blade Back-up Service is. The Ingersoll Blade Back-Up Service is an exclusive system designed to meet the objectives of the four groups of people concerned with cutting tool performance and costs: Purchasing, Tool Engineers, Shop Operating people, and Management.

- It assures the most economical blades to achieve the desired results
- It leads to better, lower-cost tool maintenance
- It permits reduced tool inventories, yet eliminates the danger of shortages and shutdowns
- It offers prompt emergency service when needed
- It gives you the benefit of research and development leading to new and improved cutting performance
- It assures the availability and fast delivery of the *right* blade, in the *right* place, at the *right* time

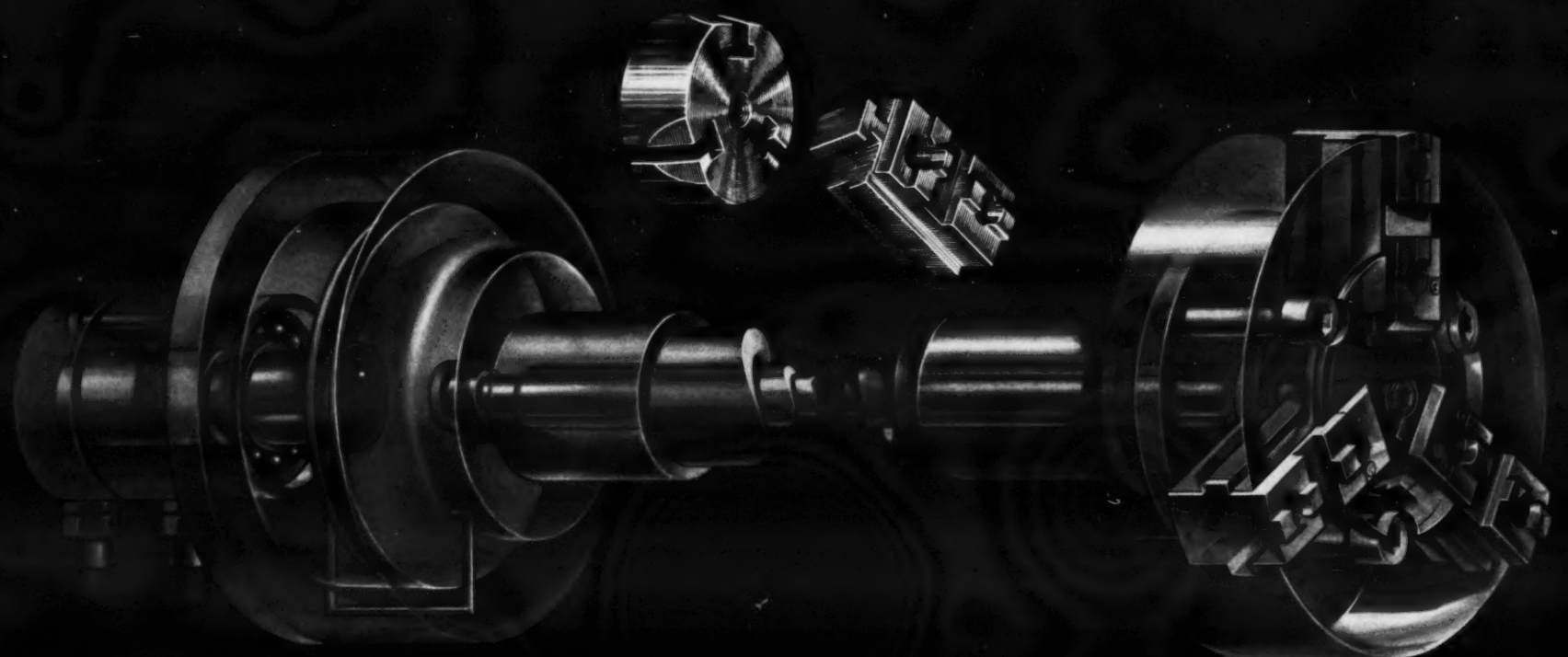
How the Ingersoll Blade Back-up Service works. Close cooperation between the customer and The Ingersoll Cutter Division can bring about spectacular results in cost reduction and in performance improvement. The Ingersoll Blade Back-Up Service permits reduced inventories in the plants of customers cooperating in this program backed up by stocks maintained by Ingersoll. The procedure includes a careful analysis of each operation, maintenance practices, inventory policies, performance requirements, and cost objectives. It includes the primary interests of operating, stores, purchasing and management personnel.

It often involves the development of new blades or cutters, the revision or elimination of grinding methods and equipment, and the modification of replacement stocks and reduction of inventory. Yet, it affords the advantages of quantity purchases of requirements preestablished by analysis of usage data.

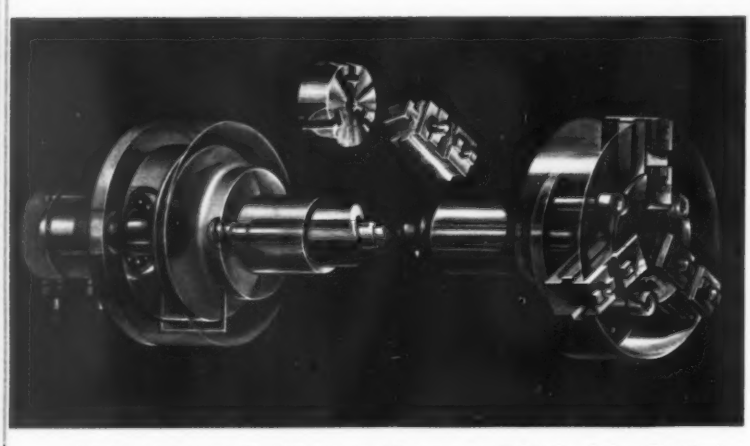
No company offering cutters and blades is better equipped for full-range service and complete responsibility than Ingersoll. Ask to have an Ingersoll sales engineer give you complete information about Ingersoll's Blade Back-Up Service. Write: **The Ingersoll Milling Machine Company, Cutter Division, Rockford, Ill.**

CIRCLE INFORM-A-GRAM KEY NO. 34

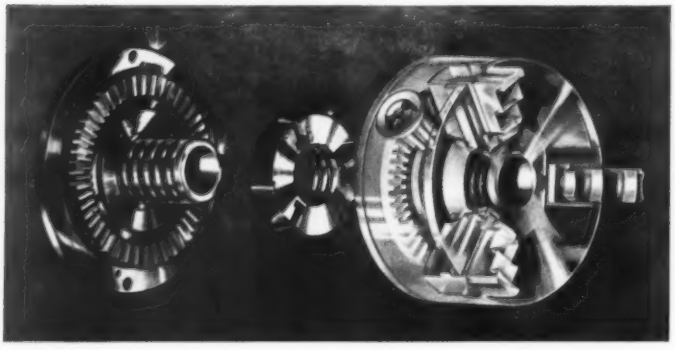
SKINNER PACKAGED POWER CHUCKING ASSEMBLY



Typical major chuck developments that come to you from SKINNER



Packaged power chucking assemblies are available for Atlas, Cintilathe, Hardinge, Logan, Regal, Sheldon, South Bend, and many similar lathes. Assemblies are also available for Brown & Sharpe and similar automatic and hand screw machines to permit chucking of cold drawn parts, small or odd shapes and castings. Packaged assemblies consist of chuck with two or three jaws, threaded drawbar and drawtube, rotating air cylinder, cylinder adaptor and necessary mounting for the individual machine.



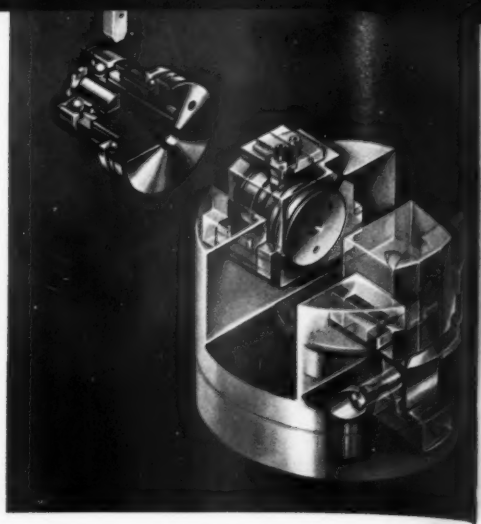
Extra-heavy-duty Wedge-Screw chuck combines best features of power and hand chucks. It develops tremendous gripping power, high accuracy and repeatability by a unique principle. When the lug-type pinion is turned manually or by a power wrench, it engages the gear plate causing the screw to move the wedge. The force of the wedge on the jaws holds the work with tremendous power.

This Wedge-Screw chuck has such useful features as:

Accuracy—within .001 total indicator reading
Repeatability—within .0005 total indicator reading
Complete Range—no size limitation

Many other features including over-tightening and operator protection, sealed operating mechanism, automatic lubrication, etc.

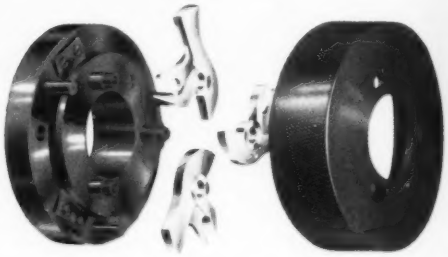
For complete details about packaged power chucking assemblies, indexing chucks, wedge-screw chucks, +GF+ Work Drivers, other chucks and chuck equipment, contact your Skinner Representative or Distributor, or write us at the address below.



Heavy-duty power chuck with jaws that index freely under full pressure. Indexing is simple, easy, and fast. The operator can index manually without touching the work or releasing the pressure. Jaws are indexed by means of a lock screw and slide plate. Note the size and shape of the indexing pin. It fits firmly and positively into the indexing plate so that extreme accuracy of indexing is assured.

One or both jaws can be furnished with indexing mechanisms. As a result, you can index more positions and smaller index angles. There is no need to buy a new chuck for different indexing positions because index jaws or index components can be interchanged quickly and easily.

This new Skinner chuck is available in all body diameters from 12″ through 36″.



+GF+ Work Drivers distributed by Skinner, are the best clamping devices available for driving rough or smooth blanks between centers. Eccentric jaws with floating spring action hold firm, and any increase in cutting tool pressure and or spindle speed automatically increases the holding power of the work driver. The jaws are easily reversed to accommodate changed direction of spindle rotation.

The protective hood covers all mechanism and provides means of manually opening and closing jaws. A slight turn of the hood, with surface cross-hatched for sure grip, opens jaws and holds them open until work is placed between centers—another turn releases jaws to grip work. **+GF+** Work Drivers are available to hold work ranging in diameter from $1\frac{1}{32}$″ to $8\frac{1}{4}$″.

Maximum eccentricity of any piece is $\frac{3}{32}$″. Finished adaptor plates or rough castings are available for mounting on all types of machines.

SKINNER CHUCKS ®

THE CREST OF QUALITY

SKINNERCHUCKS

THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT, U. S. A.

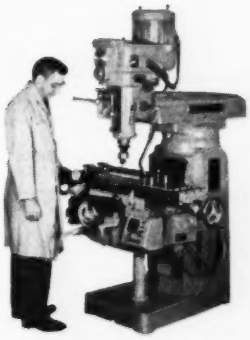
PRINTED IN U.S.A.

GREATEST SPEED RANGE

IN VERTICAL MILLING
65 to 4600 RPM

New GORTON VARIABLE SPEED HEAD Model 1-22 Mastermil

- The ideal head for milling high tensile strength alloys with maximum cutter efficiency.
- Remarkably smooth spindle operation throughout entire speed range from 65 to 4,600 RPM . . . insured by *unison-mechanical* change of pulley diameters, with positive control.
- Guaranteed high precision spindle of interchangeable self-contained design.
- Direct reading spindle speed dial provides fast speed selections.
- Maximum torque in low speeds through back gear design.
- Dial-type down feed—infinitely variable .250 to 4.000 inches per minute with built-in over-running clutch for feeding against positive stop.
- Traditional GORTON quality in every detail.



Write for Bulletin No. 2699 for complete description of new variable speed head and Gorton Mastermil.

GORTON

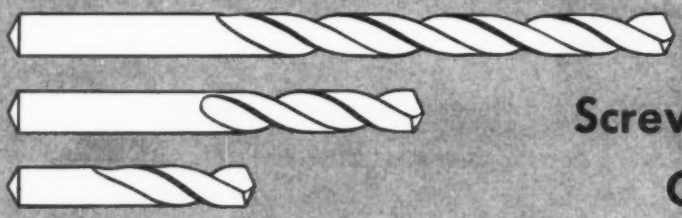
SINCE 1893

GEORGE GORTON MACHINE CO.

1210 RACINE STREET, RACINE, WISCONSIN

Milling, Die Sinking, Profiling and Engraving Machines with Manual Hydraulic, Electro-Hydraulic or Numerical Guidance Systems. Special Machines and Automated Transfer or Indexing Machines. Cutting Tools and accessories . . . Defense and special products.

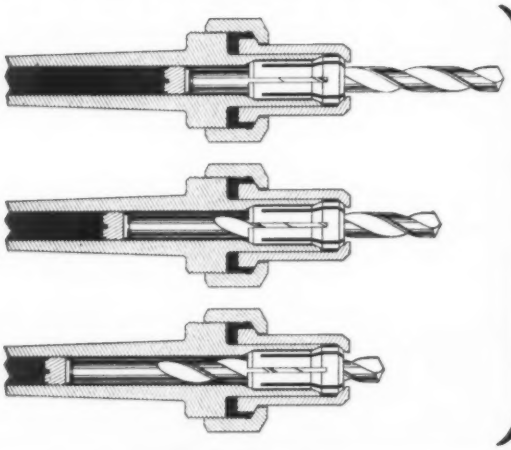
CIRCLE INFORM-A-GRAM KEY NO. 37



Jobber's Length
Screw Machine Length
Center Drill Length

WHY BUY ALL THREE?

When a jobber's length drill—held in an ERICKSON COLLET CHUCK —will serve for each!



Simply grip on the flutes*—get any extension you need!

Save tool costs! Why pay a premium for screw-machine length? Why put up with the virtually no regrind life of center-drill length? When you use ERICKSON collet chucks you buy only one drill length—stock only one drill length—and get the regrind bonus of full-length jobbers drills! Three drills for the price of one!

Minimum drill projection means longest tool life, more parts per grind and highest accuracy. Just set inner stop screw to give the projection needed. Use full jobbers length drills, even for center-drilling applications.

* The collets in ERICKSON Collet Chucks are slotted at both ends—collapse evenly over their entire length —grip drills on the flutes to within 0.0005 in. concentricity! You get the long tool-life benefits of short drill projection (as high as 5:1) yet buy only jobber's length drills. Investigate ERICKSON Collet Chucks for your applications. They are available in a wide range of sizes and models, with taper, straight, or special shanks.

The ERICKSON Collet Chuck Manual is free. It lists and describes all models of standard collet chucks. In addition, dozens of special collet chuck designs are shown. It is a storehouse of tooling information and ideas, yours for the asking.

ERICKSON TOOL COMPANY
34350 Solon Road, SOLON, OHIO
(GREATER CLEVELAND)

CIRCLE INFORM-A-GRAM KEY NO. 38

TOOLING & PRODUCTION
The Magazine of Metal Working Methods

Thanks to Public Relations

Every item in each issue of Tooling & Production is published only after serious and careful consideration with regard to its value to you.

Perhaps you have prepared an article, a paper or a report and know that your first gathering of information, pictures and drawings usually is not complete. You have to dig for more material to assure clarity.

While making the preparation, **you** come to understand the subject well, but you spend hours with it. What about the **busy executive** who reads fast with good comprehension? Chances are **he** will need more and better aids for his quick in-and-out perusal. This is where the public relations people should receive commendation.

Whether they be advertising managers, directors of public relations, vice presidents in charge of marketing, account executives, chief engineers, plant engineers or research personnel, we are deeply indebted for the quick, honest effort they make to service our additional information needs. The willingness these people display at every request is unusual. Our thanks to them for past and future help.

When we first get the thought that a certain area of metalworking should be covered in a feature, we may feel we know what is needed for a clear presentation. It usually becomes evident in a short time that more information and certain other illustrations would make a stronger story. Then the correspondence flies, and telephones ring. In a short time, many times overnight, we have the request in hand. Thanks also, Mr. Public Relations, for your blind trust that your efforts will come out all right in print and that they will finally be published. We try to suggest realistic publication dates during inception of articles, but we do miss once in a while.

Most public relations people pick their magazines well, which makes it difficult for us to turn down stories submitted. When we do reject a story, it's usually because we want to be honest with you and your effort. We can't run them all.

William E. Hoffman
Editor

FOR ACCURATE LOCATING USE UNIVERSAL LOCATING PINS

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Lock Screw Pin

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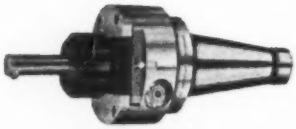
212

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

Standard Collet Chuck

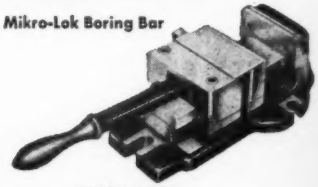
Mikro-Lok Boring Bar



Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 40

TOOLING & PRODUCTION

The Magazine of Metal Working Methods

VOL. 27, No. 7
OCTOBER 1961

Fig. 1 Bore honing machine developed by Barden uses gimballed workholder for finishing superprecise bearings.

The Evolution of 20-Millionths Bearings

THE U.S. INTERCONTINENTAL Ballistic Missile program has fostered a tenfold advance in precision bearing accuracy, dictated by the exacting needs of inertial guidance systems.

One firm that met the challenge to advance 20 yrs practically "overnight" is the Barden Corp., Danbury, Conn. Barden engineers established a number of new methods at the outset of the program. They evolved new ways to chuck parts during critical grinding operations. They removed only small amounts of stock during final grinding and lapping and thus minimized stresses. They developed machine-driven gages for measuring critical dimensions, since measuring millionths requires eliminating operator-induced errors. They conceived and built a new honing machine in five months, and then the company was ready for volume production.

Production Procedures Today

Standard and special production procedures are used interchangeably at Barden. Inner and outer rings are rough-formed in automatic spindle machines, a standard operation. After secondary machining, the parts move to heat treating and grinding. Rough grinding tolerances are 1 to 2 tenths, the same as finish grind for **standard** precision bearings.

Upon completion of the grinding cycle, parts are additionally heat treated, then processed again through the standard manufacturing steps. This is done on special grinding and lapping machines tooled and tuned to hold vital tolerances.

A newly developed machine hones the bore of the inner ring to the specified 0.000020 tolerance, and near-perfect roundness. Yet the bore squareness established by previous grinding operations is not disturbed.

Presentation of work to the hone is the quintessence of this phase of the program. Figure 1, both hone and bearing ring are free to float and follow the squareness established in the previous operation. The hone, a conventional tool, is mounted on a universal joint. The ring is mounted in the core of the three-gimbal workholder, with the center and inner gimbals being free to move as the hone operates. Gimbals, originally designed for sleeve bearings, were redesigned to use ball bearings, after their freedom of movement became restricted.

Lubrication, Special Gages

The oil-impregnated phenolic ball retainers of the bearings get special treatment because they serve not only as ball separators but also as a lubricant source. They carry only a few milligrams of oil on the initial charge which must suffice for thousands of hours of service, since it's seldom possible to relubricate bearings once they're installed in a component. Standard boring and deburring procedures,

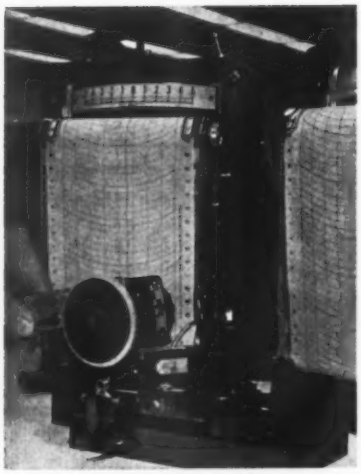


Fig. 2 This motor-driven gage measures parallelism of inner ring raceway with side at the same time radial runout is gaged. Each fine vertical line represents 10 millionths deviation.

but to far finer tolerances, are used in the early manufacturing stages of the retainers. After dimensional gaging, they are examined and further deburred under microscopes.

Barden designed a whole new group of gages for the 20-millionths program. They use motor drives and recorded readouts. After grinding operations, power-operated gages take the place of hand-operated ones. Readings are recorded on calibrated charts to eliminate individual operator interpretations.

Fanatical attention is paid to cleanliness. A special white area is used for assembly and packaging. After each operation, parts are spray-washed and scrubbed.

Just before assembly, the finished inner and outer rings are gaged and sorted according to differences of a few millionths. Balls are also classified according to size. An inner ring, outer ring, retainer and balls, all of matching relative dimensions, are assembled to form a 20-millionths ball bearing. Actual contact angle is measured to insure proper operation of the bearing, since contact angle is critical for proper bearing operation.

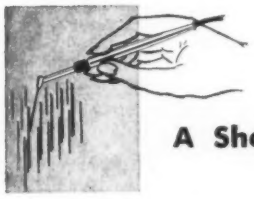
Torkintegrator

Another Barden-developed instrument, the "Torkintegrator," takes over after assembly. It measures the force required to overcome internal bearing friction. A preload gage, another Barden design, measures stickout of inner ring to outer ring under a specified thrust load, a dimension furnished as part of the documentation of the bearing.

After final testing, each completed bearing is reimpregnated with the precise amount of oil to replace oil loss in testing and cleaning. The finished bearing travels in a sealed polyethylene envelope, plus a sealed foil bag.

Each bearing is numbered serially, as are its inner and outer rings. When shipped, each bearing is accompanied by the compilation of recorded data as evidence of compliance with dimensional and functional specifications. A separate tally sheet lists the critical dimensions for inner and outer rings to the nearest five millionths of an inch. Usually dimensions have variations less than the allowable 20 millionths maximum, many being accurate to 10 and even 5 millionths. Balls are controlled to 3 millionths.

The case history of each 20-millionths bearing installed in inertial guidance gyros is maintained at Barden, along with duplicate data, the climax to the more than 100 precision manufacturing, assembly and inspection operations. ■



A Shot in the Arm for Production

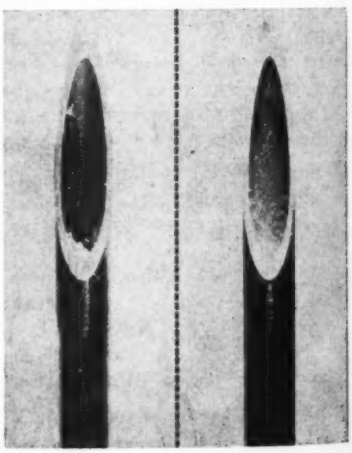
Hypodermic needles are turned out faster, and they're less likely to cause discomfort in use, thanks to a high velocity abrasive deburring process working at Vita Needle Co., Needham, Mass.

The machine doing the deburring is the industrial Airbrasive unit made by S. S. White Industrial Div., New York City. It propels abrasive particles at 1100 fps. The machine permits Vita to handle 100 needles at a time instead of the old one-at-a-time hand probe deburring method.

The new technique has boosted needle production 10 to 12 times, to assure a higher quality needle, one that has smoother edges and is free of residual burrs and slivers within the lumen or hole. Additionally, the intersection of the bevel plane with the ID at the heel of the needle is much less likely to "cut a plug of flesh" while being injected, according to M. N. Hartman, Vita's production manager.

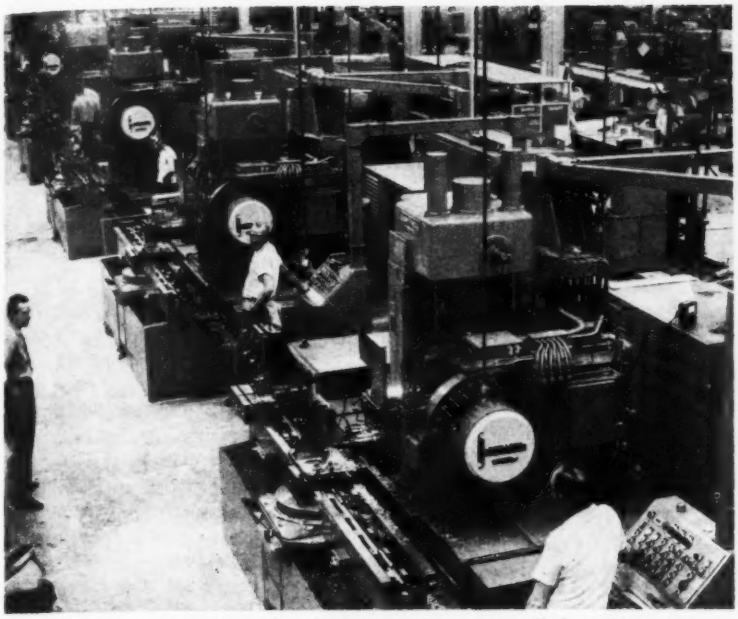
Material being cut is Type 304 stainless steel, with tubing ranging from 0.109 to 0.010 dia, and wall thickness from 0.002 to 0.012. Ordinary shop air, filtered by a special S. S. White filter-drain, can be used to propel the abrasive stream of 50 micron aluminum oxide.

S. S. White officials say their Airbrasive unit is also suitable for cutting or abrading hard brittle materials, e.g., cutting ferrite, silicon and germanium; cutting shapes from tungsten sheet 0.005 thick.



Airbrasive deburred needle on right compared with one still to be deburred.

From the Cover:



Largest concentration of a single type of tape-controlled machine at Wichita is this row of five Milwaukee-Matics.

Automatic Manufacturing

Gain Confidence from a Veteran

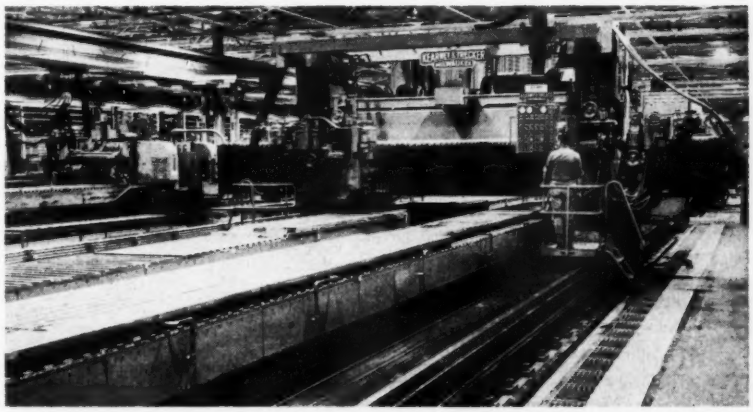
MANUFACTURING PLANNERS continue to watch the potential of numerical control as a means to slice tooling and production costs. They are increasingly inclined to seeks ways NC can save them money, in terms of real experience in plants where the tape control technique has been given a significant workout.

NC specialists at the Wichita Div., Boeing Company, have been working with tape technology for more than four years. They've worked with all phases of NC and by this time have collected a massive amount of comparative cost data. Although Boeing-Wichita is best known for its skill and efficiency as an aircraft manufacturer, its NC experience is not limited to the fabrication of aircraft parts. Since establishing the Boeing Applied Computing Services (BACS) at Wichita, the company has done work in areas including the automotive, electrical, ceramic and missile fields.

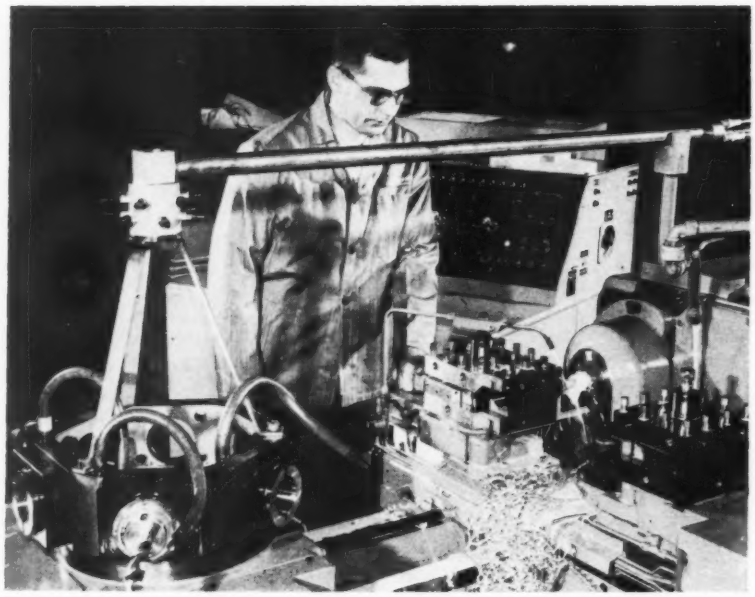
Boeing now has 19 tape-controlled machines working at the Kansas plant. These include five Kearney & Trecker Milwaukee-Matics using the GE punched tape system; three K&T profilers with Bendix punched tape; two Jones & Lamson turret lathes with punched tape by J&L; three K&T skin mills with GE magnetic tape; one Morey profiler with GE magnetic tape; one Pratt & Whitney three-spindle Keller with Bendix punched tape, and four DrivMatic riveters using film photo-electric control. Production use of this variety of machines has given the company an unusual command of the field, and additional units are on order.

Boeing NC veterans have concluded that the money-saving aspects of tape control are these: (1) It reduces machining time, (2) requires less setup time, (3) cuts down on rejects, (4) helps keep inventory down, (5) reduces lead-time, and (6) holds down tooling costs.

All these advantages should accrue if a plant, in entering the NC field, operates the program in a fully coordinated and well-advised way, with provision made for the plant's particular requirements, and the whole program launched according to the advice of experienced consultants.



Three skin mills, like this one using magnetic tape and GE controls are largest of the Wichita facility's NC units. They do close-tolerance milling of giant aircraft wing skins.



Newest NC installation consists of two J&L turret lathes controlled by punched tape.

Some Specifics on Savings

(1) As for machine time, Boeing found that on one of the first airplane wing spars machined by tape control, the time was cut by more than 87%.

In milling a fitting tee, the company found that the machine time of 39 min/part via conventional method was cut to 12 min when the work was done on the Milwaukee-Matics.

(2) A comparison in machine setup time was made in preparing to fabricate a forged aluminum vent splice fitting for the B-52 heavy bomber. It took 18 hrs by conventional methods, 10 hrs on an NC machine.

(3) When reject volume is held down, savings mount rapidly. Consistent accuracy is one of the characteristics of a good NC program, Boeing has found. They cite an example of close-tolerance work done on an 80-ft wing skin. In this case the mill took 19 lbs of weight off the skin. Part thickness tolerance was 0.010, but only 0.003 of the tolerance was used by the tape method.

Much of the hour-after-hour accuracy of the NC machine results because the human fatigue factor (and concern) are removed from the process. Machine operators are relieved of the responsibility and strain in the constant control and maneuvering of the machine, with the result that the output is automatically of higher quality.

(4) Material inventory is reduced because parts are made faster on fewer machines. This means that a smaller amount of metal is found around a plant at any one time. In an age when expensive and high-capability metals and alloys are in much wider use, this factor assumes considerable importance.

(5) Boeing recently encountered a situation in which the leadtime advantage of NC was dramatically illustrated. A subcontractor reported that he was facing a tight production schedule on stainless steel parts of a highly complex configuration. Boeing produced the parts with its 3-dimensional WALDO (Wichita Automatic Linear Data Output) program on a K&T profiler. It required only five days to complete the entire procedure of programming, computer processing and tape-making. The first parts were quickly machined after the program was ready.

Other records show that on one of the complex airplane wing components, leadtime between blueprint and start of fabrication was formerly 28 days. The tape process reduced it to four days.

(6) Tooling costs go down in an NC plant, mainly because the tooling can be much simpler than conventional tooling. Pins and clamps on flat plates are common. As a result, the skills required for handling tooling on tape-controlled machines are less advanced than on conventional mills.

Perhaps the best indication of the company's confidence in tape equipment is that they continue to install more NC units. Boeing is a large company but there is plenty of evidence that small companies can also profit. ■

Fast, Automatic Forging

An automated forging press system has demonstrated capability to at least double production capacity while reducing manpower requirement for the operation by one half.

This is a complex developed by AmForge Div., American Brake Shoe Co., and consists of a high speed heating furnace coupled by special billet handling equipment to a stock 2500-ton Erie press which has been automated by AmForge. In addition to the obvious cost advantages, a further saving is realized through reduced exposure to atmosphere because of faster heating and handling techniques. This results in a marked reduction of scale formation, permitting forging to closer tolerances, and virtually eliminating the need for further finishing operations.

The press complex is producing track links for crawler tractors. However, its use to produce other high-volume items, such as automotive gears and high pressure fittings, is foreseen.

More Flexible Assembly with Single Spindle Riveters

FOR SOME PLANTS, single spindle machines still offer advantages over multi-spindle and multi-station machines. Theoretically, a man can set twice as many rivets on a double spindle machine as on a single spindle model but positioning problems, machine utilization rates, and other factors affect the economics of machine choice.

The most obvious advantage of the single spindle is lower initial cost. Then there are times when joint configuration or nature of the product make multiple riveting impractical. Another point is the greater flexibility of single spindle riveters; each can handle a greater variety of jobs, and can be changed over quickly from one job to another.

This last point is of special import to production specialists at Keystone Camera Co., Inc., Boston, Mass. The firm makes numerous models of cameras, projectors, and photographic gear. A camera has nearly 500 different parts, and a projector close to 1000. Joint design varies. Part finish varies. Runs in a particular model usually are not long enough for continuous production. Riveting operations are distributed throughout the plant to facilitate smooth flow of product being processed.

Despite these conditions, the plant is able to use riveting extensively to hold joint costs at a low level in line with overall production costs which enable the company to prosper in a highly competitive field. These practices are partially responsible:

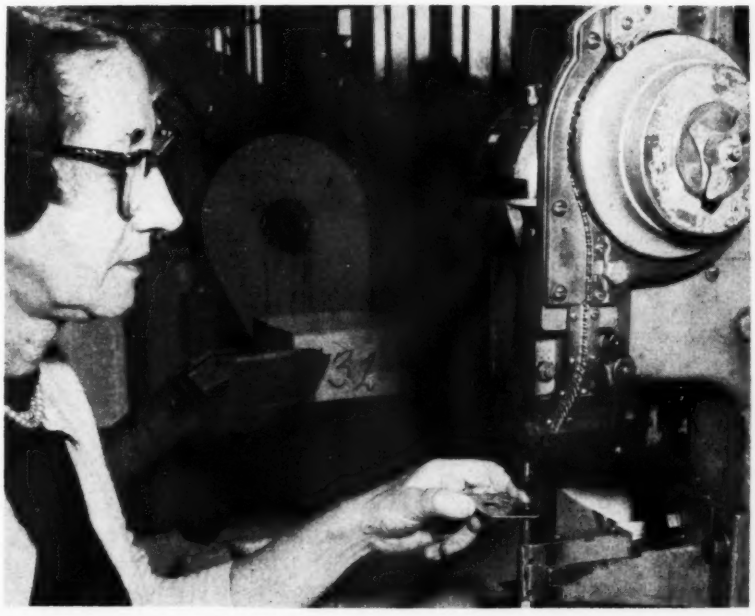
• **Recognition of assembly as an important aspect of design.** Early in the design stage, an analysis is made to determine which assembly process, technique, or fastener will be most suitable.

Points of evaluation include: 1) appearance, especially if assembly is exposed to view, 2) quality — strength, holding power, etc., 3) effect of part configuration, e.g., limited access, 4) adaptability of process or fastener to in-line assembly, and 5) joint cost.

In most cases, the decision is made jointly between engineering and production, with quality and cost being emphasized.

• **Designing for preselected standardized fasteners.** Tubular, semi-tubular or split rivets of 1/16, 3/32, or 1/8" dia are employed, and lengths are standardized. Oval heads are usually used, and finishes are confined to chromium, nickel or cadmium plate. Further standardization is pursued, and activities of the Tubular and Split Rivet Council in this direction are studied. Reduced fastener inventories, fewer stock-outs, and even greater flexibility in tooling and machine usage are the goals.

This article is presented in cooperation with the Tubular and Split Rivet Council.



Single spindle riveters are preferred for assembly operations at Keystone Camera. They provide maximum flexibility in meeting intermittent production needs.

• **Teaming up single spindle machines for multiple operations on one part.** This applies to setting two or more rivets simultaneously in one part, or arranging the machines in tandem so sub-assembly can be advanced quickly from one operation to the next. Depending on the nature of the job, one operator often operates both machines.

• **Use of machines where required, and relocation when production needs change.** Rather than colonizing the riveting operations, the machines are located in line with other operations on the particular sub-assembly. When run is complete, or model requirement tapers off, the riveter is pulled and shifted to another line.

Keystone prefers powered single spindle machines that automatically feed and set the rivet once the operator trips the cycle. Most of these are electro-mechanical types that give fast cycle time and can be easily plugged in or out of power lines when moved. Bench or pedestal single-spindle models present no size or weight obstacle to relocation.

In one typical case, prior assembly by self-tapping screws driven by air was at a rate of 0.571 hr/c. Changing to machine-set rivets reduced time to 0.240 hr/c, a time saving of nearly 60%.

• **In-plant instruction of operators on specific jobs, and orientation of new operators in riveting machines and methods.** These practices are continued by provision of a job sheet for each operation. This lists components to be assembled; size, type, and quantity of rivets to be used; schematic of physical arrangement of parts relative to machine; preferred sequence of riveting; and expected assembly rate. Operator is free to request changes to accommodate his or her ideas on improvement of the technique.

* * *

There is nothing revolutionary about any of these practices, but collectively they enable Keystone to rapidly adjust their production sequences to accommodate new products and effects of changing markets . . . without major equipment investment and without loss of efficiency. ■

Act of Confidence

Howard T. Christanson, Machinery Sales Co. president, hands Ernie Noren, Sales Manager of Bridgeport Machinery Co. of Bridgeport, Conn., an order for 600 Bridgeport machines.

Present at the signing, in addition to Christanson and Noren were Machinery Sales Executive Vice President Nathan Troop, and Vice President in charge of Sales, Kimball Smith. Troop stated that the anticipation of an early economic upturn and new defense contracts prompted the order. Mr. Noren assured Machinery Sales Co. of Los Angeles, fast delivery.

Machinery Sales Co., located at 2838 Leonis Blvd., Los Angeles, Cal., has been distributing machine tools to the West for 20 years.

Cost Reduction ABC's

COST REDUCTION GUIDE FOR MANUFACTURING MANAGEMENT, by H. Clifton Morse and E. E. Wyatt. Published by Wyatt & Morse, Inc., 332 S. Michigan Ave., Chicago 4, Ill., 1961, 244 pages.

"This Cost Reduction Guide is dedicated to . . . helping manufacturers do things better in order to make a profit."

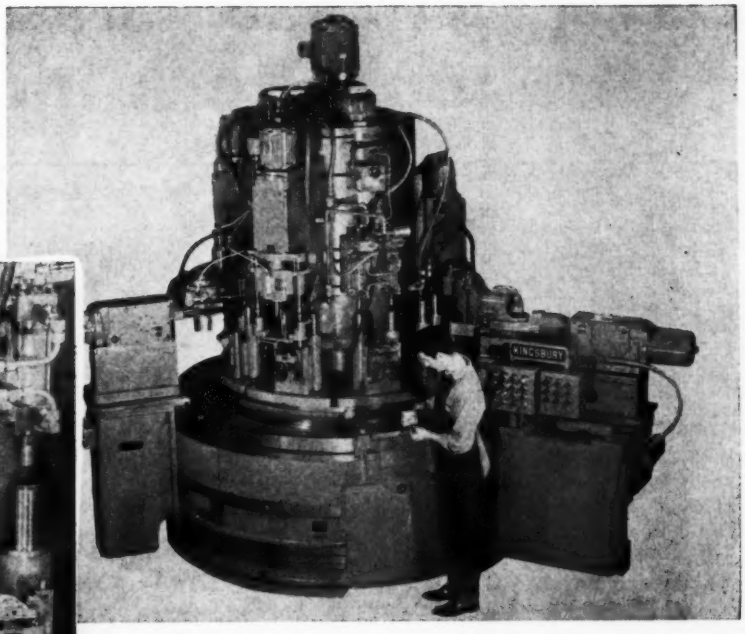
It grew from the authors' experience as consultants in planning, organizing and promoting successful cost reduction programs. It incorporates the best cost reduction methods from more than 50 companies with whose programs the authors are familiar, and whose cost reduction specialists have contributed their ideas.

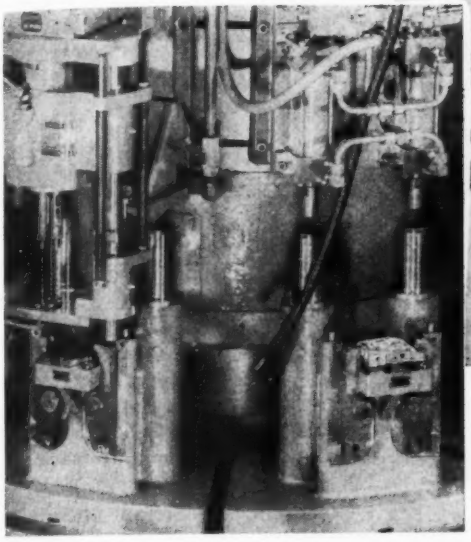
The World of Castings

ENGINEERED CASTINGS, by Glenn J. Cook. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y., 1961, 257 pages, $8.50.

Though primary emphasis is given to the use of engineered castings here, there is useful information also on how to design, make and buy them.

Mr. Cook is marketing manager of General Electric Company's foundry department. His topics include sand molding, shell molding, investment casting, die casting, inspection and testing, vacuum casting, materials, casting design and tolerance and foundry selection. Unlike many current texts, the book considers all modern metals and processes applicable to casting.





A Kingsbury Center Column . . . and 300 bodies/hr

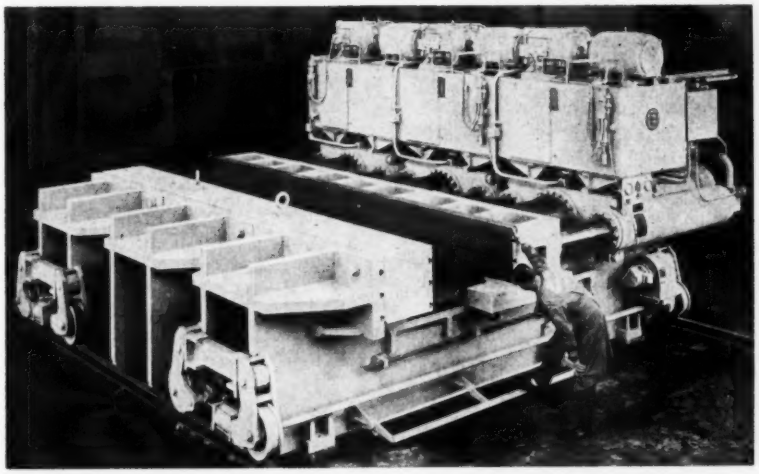
The Ford Motor Company uses this seven unit, 14-spindle machine to mill, drill, countersink, and tap at a rate of 300 parts/hr. A 63″ index table holds 8 work fixtures with power clamping and automatic unclamping. The work rests on its finished face and is located on pins. The clamps are actuated by spring-loaded rams.

Two horizontal units rough and finish-mill the throttle body face. The finish mill rotates at 3600 rpm for a 50 rms finish. Five vertical units finish six holes; the last one has a mechanical probe for broken taps before finish-milling. In the event taps are broken, the table stops and a light glows on the operator's panel. For additional information, circle No. E10.

Colossal Pressure

A titan, commonly known as a "bulldozer" and said to be the largest horizontal forming press, shapes steel in larger pieces than previously possible.

Built by Lake Erie Machinery Corp., Buffalo, N.Y., a subsidiary of Bell International, the bulldozer has been installed at Adams Div., LeTourneau-Westinghouse in Indianapolis. Credited with a total ram pressure of 2550 tons and a 6 ft ram travel, the unit is hard at work forming frame members, mold boards and other components for giant earth moving equipment. The three 850-ton presses that comprise it work in unison, or independently. A track allows railroading of outside units to desired locations throughout the plant. The



press is 20 ft wide in its three-in-one nature, 27 ft long and 12 ft high. Each unit has a 60-hp motor and starter and each motor drives an oilgear 44.6 gpm pump. Circle Inform-A-Gram No. E1.

Manhours to Minutes

FABRICATION TIME HAS BEEN reduced from several manhours to one minute by using automatic welding and forming machines. This development by United Welders, Inc., Bay City, Michigan, allows production of joists to order, rather than for stock. Coils of strip and rod, the machine's raw materials, will be stocked rather than the complete joists. By this, storage space will be drastically reduced and intermediate handling will be almost eliminated.

Fabrication cost, which represents a substantial part of the total cost of a joist, has also been materially reduced and designs have been standardized to 25 sizes with specific dimensions for depth, width, and pitch related to custom-fitted spans. Various machines in the line are duplicated so any two of the 25 standard sizes can be fabricated simultaneously.

Chord Preparation

Flat coil stock for the top-chord member is uncoiled and leveled at the start of one leg of the line. The leading end of a new coil is sheared off square so it can be joined to the square trailing end of the previous coil. By joining coils this way the strip can be pulled through succeeding operations by pinch rolls.

After welding has been automatically made, the stationary clamp pressure is reduced and the strip pulled through integral top, bottom, and side trimming dies to remove the still warm flash. After that the top surface of the strip is brushed to remove chips as it leaves trimming dies.

Bottom chord member is prepared in a similar fashion.

Operation of this equipment is automatic and can be adjusted to take all stock sizes; strips of different thicknesses, and/or widths, can be joined without difficulty. Following forming, chord sections are cut to length and bundled for delivery by crane to joist-welder storage conveyors.

Web Forming

Rod is uncoiled at one end and trailing and leading ends are welded together here also to form continuous rod. It's straightened and sheared to exact length for joists on order.

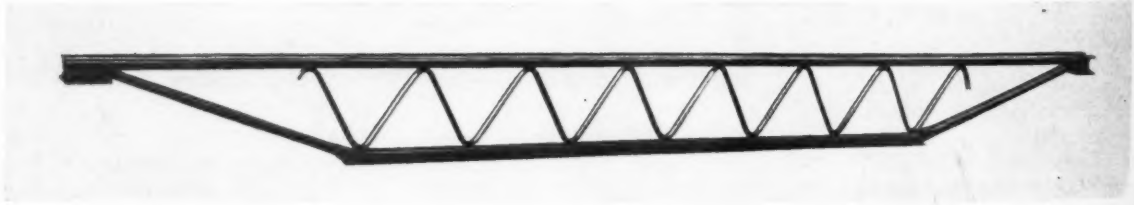
Rods range from 1/2 to 13/16″ in diameter while panel pitch can be either 16 or 24″. Panel heights go from 6 to 21½″ in nine steps. Required web can go 45′ long, but the machine can be quickly adjusted to different sizes. When 12 (or less, depending on size of the joist order) rods are crowded against the stop gage the operator initiates the completely automatic stretch-bending operation. This includes the initial and final bend of the web ends and ejects the finished webs on the unloading table.

Bends were formerly made one at a time on one rod at a time. With this new setup at least 60 webs/hr are prepared — enough to supply both joist-welding machines.

Joist Welding

For welding, top and bottom chords as well as webs, are mechanically spaced on their respective storage conveyors. They move laterally while two operators orient the top and bottom chords on shuttle-feeders after which the two chords and a web are picked from the feed position by the arms of a rotating preloader. It presents them to the loader. The loader holds them together while elevating the oriented assembly into welding position.

Fig. 1 Clean appearance and high strength are characteristics of completely fabricated joists manufactured on this welding line.



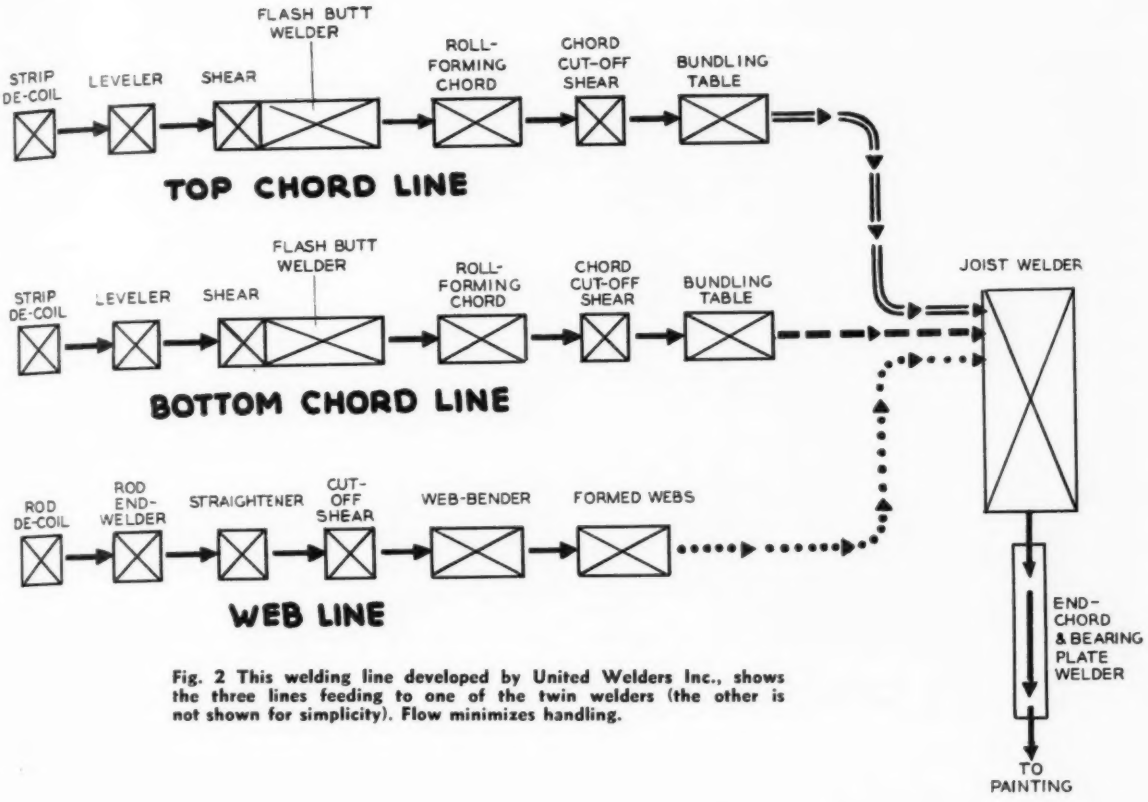


Fig. 2 This welding line developed by United Welders Inc., shows the three lines feeding to one of the twin welders (the other is not shown for simplicity). Flow minimizes handling.

These welders can turn out about 30 partially finished joists/hr even though the complex gaging stops and transferring mechanisms accommodate 25 different sizes and numerous spans. Even with this complexity the machine can be changed over in no more than five minutes for various pitch joists.

After this welding, the joist is unloaded onto a roller conveyor that delivers it to the end-chord and bearing-plate welding machines. Each of these machines has two identical mirror-image work stations — one for each end of the joist. One work station is mounted on a carriage riding on rails to adjust to joist length. Here equalizing guns attach both ends of the end-chord to the top and bottom chords by three overlapping spot welds. The same guns projection weld the bearing plates which are automatically fed into place from storage magazines. Now the joist is complete and travels to the paint shop. ■

Extra copies of this article are available while supply lasts. Write Tooling & Production Magazine, 1975 Lee Rd., Cleveland 18.

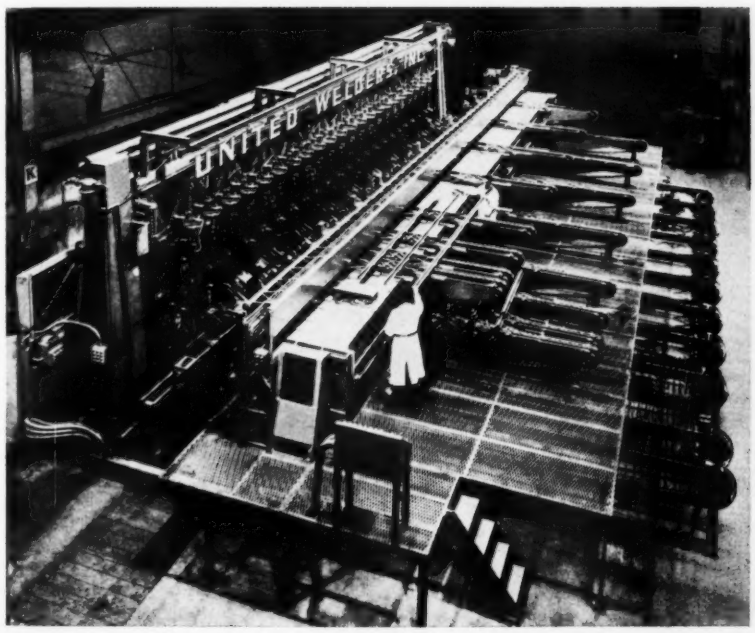


Fig. 3 The joist-welder includes storage conveyors that feed chords and webs to the left. Individual components are picked up by pre-loaders and transferred and clamped in the welding station. All welds are completed in less than three seconds in a cascade-like operation.

Sometimes Obsolescence Is Only a Word—

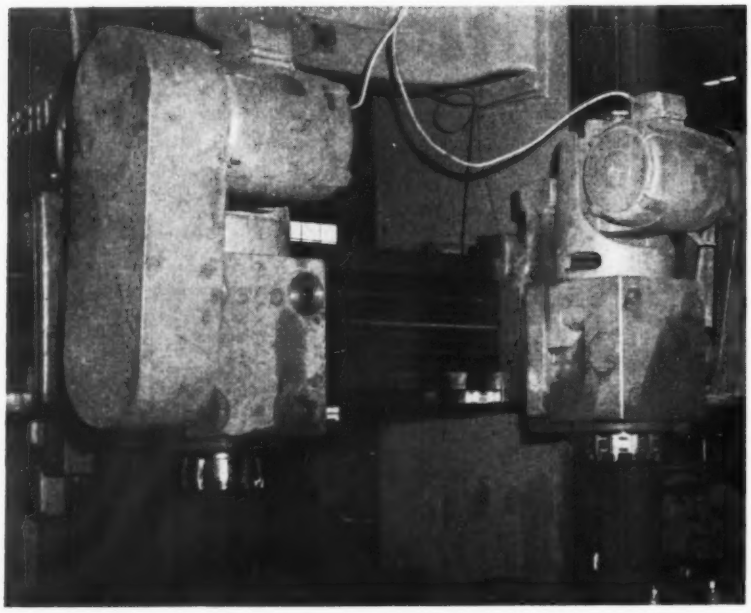


Fig. 1 Master "building block" components give old planer new lease on life as capacious, versatile, high-production planer-miller.

New Life for Old Planers

THOUSANDS OF FINE OLD planers have been shoved to the sidelines by new grinders and millers that can take heavy cuts, and seem more convenient to use. Most of those planers have probably more than paid for themselves, and have been "written off." Nevertheless, they represent a tremendous metal removal potential, which is now seldom employed.

Before you dispose of a planer, investigate the line of "building block" conversion heads lately released by Master Manufacturing Co., Hutchinson, Kan. These permit ready conversion of existing machines to excellent high-capacity planer-millers of many uses.

The application of a Master conversion head exploits the ruggedness and huge table capacity of the planer in machining parts too large for the ordinary miller. Inherent traits are retained and milling is permitted where needed and planing can still be done on the same machine, with little or no set-up change or workpiece repositioning.

The degree to which a planer can be modernized by "building block" components will depend on its size, type and condition, work to be done and investment consistent with the job at hand. Some planer conversions may require reworking of table or crossrail ways, rejuvenation of electrical or hydraulic controls, of way protectors and other versatility improvements.

Most planers require only a machining head of 5 to 20-hp attached to the crossrail saddle of the planer, and the addition, if not already present, of a variable speed drive to reduce table speed to within milling feed rates. Where cost is a serious problem, used truck transmissions have been successfully applied to this function.

To cite one of many examples of conversion, Parkersburg Rig & Reel Co., Hutchinson, Kan., restored an "old-timer" to utility and versatility through Master attachments. This was an old Liberty planer, a machine tool that is no longer manufactured, and for which Parkersburg was finding less and less work. It was converted to a very useful planer-miller by attaching two 20-hp Master machining heads (Fig 1). Table speed reduction was effected by driving the table with a hydraulic motor through a truck transmission (Fig 2).

When using the conversion head, the regular planer drive motor is used only for rapid traverse. This leads to a reduction in way maintenance, since the milling operation usually requires only a few slow passes, compared to the many fast passes of the planer version, which does no cutting on the return stroke.

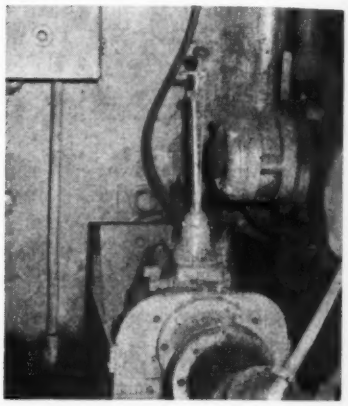


Fig. 2 As economical means of slowing planer table to milling speeds, old truck transmission is utilized for reduction for hydraulic motor.

These conversions are not "something-for-nothing" which can necessarily be snapped on overnight. Nevertheless, they have demonstrated ability to modernize existing equipment with negligible effort, and at a small fraction of the price of newer machines of similar capacities. For further information write Master at 1300 East Ave. "A", Hutchinson, Kan., or circle Inform-A-Gram No. E2.

Work Feeding Method Speeds Two-Face Grinding

INGENIOUS TOOLING has had much to do with the growing usefulness of the double spindle disc-grinding technique of finishing two opposite flat faces simultaneously. With proper choice of work feeding method and careful design of fixtures, high production rates can be attained for the least possible unit cost. This benefit is a worthy supplement to the inherent process capability for holding close tolerances on parallelism, squareness, flatness and surface finish.

Choice of feeding method is influenced by the size and other physical characteristics of parts to be ground. Production volume is another decisive factor, according to experience gained at Mattison Machine Works, Rockford, Ill.

A basic requirement in all setups is that any part of the tooling to enter between the grinding discs must be of a thickness substantially less than the dimension between parallel grind faces after grinding. One fixture can generally handle various part styles if it is designed for the use of interchangeable workholders.

An oscillating or reciprocating feed method is often employed. Where lot sizes are small, it permits simple hand-operated fixtures to be used for small parts. The fixture is on a swinging arm, trunnioned from a level in line with the bottom of the grinding discs, or lower, according to the general size of parts being processed. By means of a hand lever, the fixture with workpiece is simply swung into grinding position between the two discs, and retracted in the same manner.

Parts May Float Or Be Held Rigidly

Where the ratio of workpiece grind area to thickness is large, tooling is designed for workpieces to float in the fixture so that they automatically orient themselves for proper entry between the grinding discs. Where the ratio of thickness to surface area is great, fixtures must hold the workpieces rigidly clamped during the grinding action. This method allows parts to be ground perfectly square.

Some oscillating fixtures are double-ended. In these, each of two work carriers holds pieces singly or in multiple, with a pivotal point at mid-height. While the one workholder is swung in between the grinding discs for finishing, the remaining section is loaded.

A less-familiar method of feeding is by reciprocating worktable. The hydraulically operated "on-edge" table holds the part rigidly in oriented position while traversing between the grinding discs, then retracted.

Rotary-Type Feeding

The rotary-type fixture has a circular carrier plate in which radially-disposed openings retain the workpieces. These usually float while ends are being parallel surface ground. A partial hood over the carrier plate keeps workpieces from immediately leaving this plate as they emerge from between the grinding discs. At a point where they can fall directly into a chute, they are released or ejected from the carrier.

Frequently, however, clamping arrangements must be provided around the fixture periphery to hold parts clamped in oriented position during grinding.

For many simple parts like small short rods, hardened V-block stations can be provided around the periphery of a rotary disc. The parts usually are held firmly in position by a continuous-type clamp, such as can be devised using a chain belt. There are other times when the part shape will necessitate individual clamps.

Photos Courtesy of Mattison Machine Works

Fig. 1 Workpieces, magazine-fed from left, enter shaped openings in the thin rotary plate which feeds them between the opposing abrasive discs for finish grinding of parallel faces. In this setup, the part floats during the grinding operation. Emerging from under the carrier hood, the finished part is ejected onto the take-away chute.

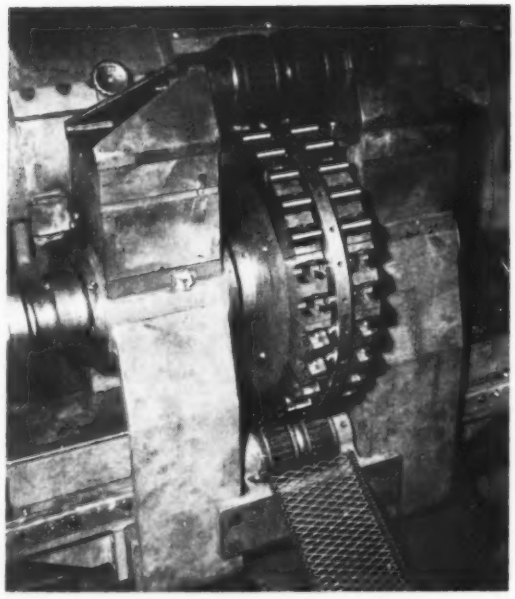


Fig. 2 In rotary feeding of tappets to a Mattison double-disc grinder, workpieces are clamped tightly in vees along the work carrier's periphery by means of a continuous silent chain. A double carrier is used, only one end per tappet being ground in this setup.

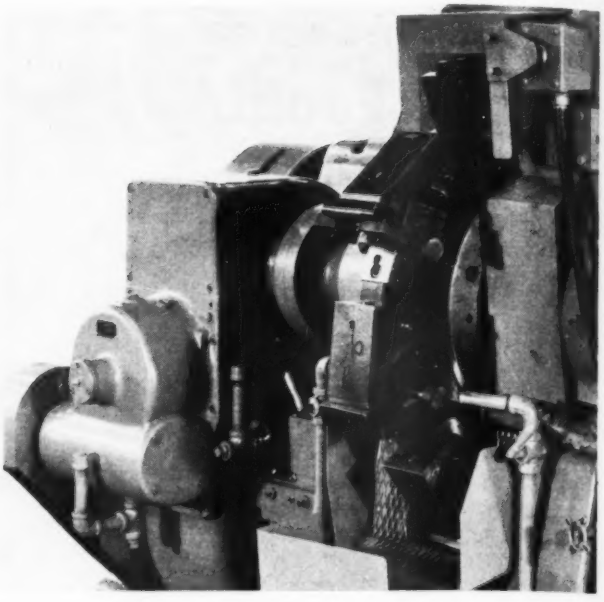


Fig. 3 Individual clamps on the rotary carrier hold universal-joint needle cups for grinding parallel end surfaces. After emerging from between double grinding discs, workpieces are released and dropped into the expanded metal chute.

Straight-Through Feeding

Both reciprocating and rotary feeding methods utilize exit of parallel-ground parts at the same side of the grinder where they enter, while a large number of parts are well adapted for straight-through grinding. Workpieces that roll are readily passed between the two grinding discs by means of a track developed for the purpose. Magazines are often provided to facilitate loading of parts.

Rubber-covered rolls are often used to "walk" such parts as gaskets and piston rings between the grinding wheels, passing them straight through. Even such parts as carpenter blades are fed this way, after first being brought by a series of V-belts into a magazine and from there by a flat belt to the rubber rolls.

Double disc grinders often incorporate power wheel dressers, automatic work sizers, remote controls for advancing the grinding heads to compensate for wheel wear, ammeters to indicate wheel action, and other refinements. All are important. However, careful choice of a feeding method and the development of proper fixturing is just as important. This is a facet of the art which is worthy of careful preliminary study. ■

Fig. 4 Inclined magazine, with "roller-skate" weights to assist gravity, keeps chain saw blades lined up for end-to-end feeding straight through the Mattison grinder. A shuttle mechanism keeps them moving. Double grinding discs finish both sides of each blade simultaneously.

Machine Replacement For The Shop Manager

Chapter IX - Example of Replacement Calculations

CHAPTERS I THROUGH V discuss the measurement of earnings from new machine tools, and Chapters VI through VIII develop a practical method for translating these earnings into a rate of return on the investment. This final chapter will show how to measure earnings and calculate return on examples that have been particularly troublesome.

When it can be proven in some way that a proposed new machine can give a spectacular production improvement, there is no difficulty in purchasing it. Almost any replacement calculation will "prove in" that machine. The problem has been the non-spectacular cases, where judgment tells us a machine should be replaced, but where the figures don't back up judgment.

by Baxter T. Fullerton

Mr. Fullerton is Director of Marketing Services, The Warner & Swasey Company, Cleveland, Ohio.

Non-spectacular Examples Require Judgment

Most examples in this chapter will be of the "non-spectacular" variety. They will show savings that are difficult to measure, and in which estimates of values are necessary—estimates that must be expressed in the calculation. The examples show various ways it can be done.

Each of the new machine tools used as an example could show a much greater production increase in actual practice. The increase in productivity in each case depends on the requirements of the work, and on the conditions in each shop. We've arbitrarily assumed conditions that would lead to a modest increase in order to show that greatly increased inherent productivity is **not** always necessary in a good replacement investment.

In spite of modest production increases, every one of these cases shows a rate of return that makes the new machine an excellent investment. The decision to purchase or not sometimes depends on other factors, such as the availability of money or other investment opportunities. These factors are usually outside the responsibility of the shop manager.

It **is** your responsibility as shop manager, however, to see to it that the people who make these decisions have the benefit of your judgment on machine replacement investment opportunities. These chapters are an effort to help you meet this responsibility.

In each of the examples, the arithmetic calculation will follow the form suggested in Chapters II and III. Obsolescence (overcome by a new machine's improved design) and deterioration (the effect of wear on the old machine) will be measured separately. Each example will require reference to the "Table For Finding Rate Of Return On Machine Tool Investments" introduced in Chapter VIII.

1 A $45,000 Saddle Type Turret Lathe

In a department of several lathes of various ages, a 1942 model has been gradually downgraded in recent years and now seems ready for replacement by a new machine. All work is typical turret lathe work in a variety of 2 to 25 pc lots. The new machine will run two full shifts by replacing one machine and partial time on a second machine.

Finding the Earnings

Obsolescence — In this situation, it is not practical to measure by time studies the increased production resulting from machine's design improvements. Fifty percent more horsepower, 50% higher top spindle speed and improved headstock shifting and machine handling will each cause substantial improvement in some jobs, and minor improvement in others. We estimate that they will add up to a 20% production improvement.

This is translated into hours as follows:

1) Add the estimated percentage increase to 1
   $1 + .20 = 1.20$
2) Put down the number of an-

nual hours at normal shop load the new machine will operate 4000 (2 shifts) hrs

3) Multiply (1) by (2) to get equivalent hours on old machine(s)
$4000 \times 1.2 = 4800$ hrs

Deterioration — Obsolescence is far from the whole story. The savings because the old machine is worn out must still be measured. The old machine has been downgraded to the bottom of the line and, as explained in Chapter III, we must estimate the effect of all the successive savings that will follow from putting a new machine at the head of the line and moving each one down a notch. In this case, we judge that **if it were handling the most difficult jobs in the department** the old machine's efficiency is only 75% of its efficiency when new. Scrap, maintenance and downtime are all included as a part of this figure, since they are not significant enough to be measured separately.

Deterioration is added to the obsolescence savings in the following manner:

4) Estimate the deterioration of the old machine(s) by stating its present efficiency as a percent of its efficiency when new
75%

5) Divide "old" machine hours (3) by (4) to get total old hours being replaced including deterioration
$4800 \div .75 = 6400$ hrs

6) Subtract "new" from "old" hrs
$6400 - 4000 = 2400$ hrs

7) Multiply by "value of the man-hour" (see Chapter IV) to get earnings
$2400 \times \$4.30 = \$10{,}320$
or $10,500

The Investment Calculation*

New machine cost (installed)	$45,000
Less market value (old machine)	5,000
Net investment	$40,000

8) Divide earnings by net investment to get Gross First Year Return
$\$10{,}500 \div \$40{,}000 = 26\%$

9) Read "Table for Finding Rate of Return on Machine Tool Investments"

True Rate of Return after Taxes	16%
Equivalent Rate of Return before Taxes	32%

Conclusion

Considering the versatility of this machine tool, and the relatively slight risk, this is an excellent investment return.

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* In none of the examples do we make the allowance frequently made for the cost of additional power or increased property taxes.

If property taxes are particularly heavy, deduct one-half (because of a corresponding income tax credit) the amount of the tax increase from annual earnings. In most cases it can be ignored. It won't make a difference of one-half of one percent in your answer.

Power consumption depends on the total amount of metal removed more than on the time it takes to remove it. Since there is no difference in the total number of pieces being machined, there should be no significant difference in power cost.

2 A $30,000 Knee Type Milling Machine

A 1945 model milling machine, one of several older ones, has been causing increasing scrap losses, and is being considered for replacement. The machine has been handling a standard variety of milling work and the entire shop is now on one shift.

Finding the Earnings

Obsolescence — The new machine has considerably more horsepower than the old model, but much of our work is too frail to enable its full use. Sample production studies indicate that more horsepower will give 50% increased production on the 30% of our work that can use it — a net gain of 15%. We estimate, also, that the automatic table cycle and other control features will add an additional 10% to production. Total production gain will be 25%.

1) Add % increase to 1
$1 + .25 = 1.25$

2) Number of annual new machine hours 2000

3) Equivalent "old" hours
$2000 \times 1.25 = 2500$ hrs

Deterioration — Here, scrap is important enough to be measured separately, but there are also other evidences of deterioration. Cutters don't hold up as well as they once did; there are off-tolerance pieces not quite bad enough to scrap; maintenance and downtime are up; production time is lost trying to get good work. We estimate that measured by these and other evidences of deterioration our old machine is only 80% as efficient as it was when new.

4) Present efficiency of old machine 80%

5) Divide (3) by (4) to get total "old" hours
$2500 \div .80 = 3125$ hrs

6) Subtract new from old hrs
$3125 - 2000 = 1125$ hrs

7) Multiply by $ value of man-hour
$1125 \times \$4.30 = \$4{,}838$

Scrap loss has been running 5% higher than normal, with the result that 100 hrs on the milling machines have been lost. An additional 100 hrs has been spent "saving" scrapped pieces, and $1000 worth of castings that can't be saved have been scrapped.

8) Calculate scrap loss
200 hours $\times$ \$4.30 = \$860
Castings 1000
\$1860

9) Add the savings (7) plus (8)
$\$4838 + \$1860 = \$6698$
or $6700

The Investment Calculation

New machine installed cost	$30,000
Less market value old machine	3,000
Net investment	$27,000

10) Gross 1st year Return
$\$6700 \div \$27{,}000 = 25\%$

11) Refer to Table

After Tax Return	15%
Equivalent before Tax Return	30%

Conclusion

An investment equally as good as the first example, especially considering that earnings would be doubled when and if we go to two shifts.

3 A $16,000 Vertical Drilling Machine

In a department with several older drilling machines, one class of work requires several drilled holes and one bored hole. The boring has been done on the older style drills, but tolerances have recently been tightened to the point that a new drill or a second operation on a boring machine is necessary. The new machine would be busy one shift on this work. Time is now available on a boring machine, so our calculation is only for the purpose of deciding whether to buy a new drill or use present equipment.

Finding the Earnings

Obsolescence — Here, the nature of the work has created obsolescence. The new design drill is better able to hold boring tolerances. With the tightened tolerance, average drill time on a half-dozen representative pieces will be 35 min, and boring time, including pro-rated setup, will be 10 min. On a new drill, total time including boring time will be 37 min.

Working with "old" time (45 min) vs. "new" time (37 min) rather than percentage production increases changes our arithmetic, but gives us the same type of answer at step (1).

1) Divide "old" time by "new" time $45 \div 37 = 1.22$
2) Number of annual new machine hours 2000
3) Equivalent "old" hours $2000 \times 1.22 = 2440$ hrs

Deterioration—Aside from their inherent inability to handle accurate boring, the old machines have deteriorated. We estimate their present efficiency as 90% of what it was new. Our calculation, though, is not for the entire 2440 "old" hrs, but only for that percentage of the old hours represented by time on the drill, in this case 1890 hrs.

4) Present efficiency of old machine 90%
5) Divide "old" drill hours by (4) $1890 \div .90 = 2100$ hrs
6) Hourly savings from deterioration $2100 - 1890 = 210$ hrs
7) Hourly savings from obsolescence $2440 - 2000 = 440$ hrs
8) Total hourly savings $440 + 210 = 650$ hrs
9) Multiply by $ value of man-hour $650 \times \$4.30 = \$2795$ **or $2800**

In this case there is a further significant saving that can be measured fairly easily — trucking expense connected with the additional operation. The work would require four trips per day from the drill to the boring machine. Each trip will take 6 min, and, at $5.00 per hour trucking expense, would cost 50¢.

10) Calculate annual trucking cost $50¢ \times 4$ trips $\times$ 250 days $= \$500$
11) Total savings $\$2800 + \$500 = \$3300$

The Investment Calculation

New Machine installed cost	$16,000
Less market value old machine	1,500
Net investment	$14,500

12) Gross 1st year Return $\$3300 \div 14{,}500 = 23\%$
13) Refer to Table

After tax Return	14%
Equivalent before tax Return	28%

Conclusion

A very good investment considering unmeasured savings in lead time and inventory, and the additional open time left available for other work on the boring machine.

4 A $200,000 Planer Mill

A shop is now using a 1938 model openside planer and a 1941 model planer mill. Much of the work the machines are now handling stretches their dimensional capacity, and an additional 500 annual hrs of work of a size too big for these machines is going to hit the shop in a few months. Should a new planer be purchased or should the new work be farmed out? The new machine will be busy two full shifts. We would sell the old planer.

Finding the Earnings

Obsolescence — We consider, first, only the work presently going on the old machines. The new machine will be larger and better suited for much of this work. Sample production estimates show that increased horsepower and more rigid way construction will allow a doubled feed rate, and with the new pendant controls over-all productivity will increase by 70%. Lack of proper size on the old machines has also meant that some of the work couldn't be finished to specification. Some 500 hand fitting and assembly hours will be saved — and included later in the calculation.

1) Add % increase to 1 1.70
2) Number of annual new machine hours 3500 (on "old" work)
3) Equivalent "old" hours $3500 \times 1.7 = 5950$ hrs

Deterioration—The obsolescence factor has measured the advantages of improved design and larger machine. In addition, the old machines have deteriorated so that they are no longer as efficient even if the work were the right size. We estimate that they are only 75% as efficient as they were when new.

4) Present efficiency of old machines 75%
5) Divide (3) by (4) to get total "old" hours $5600 \div .75 = 7933$

6) Add hand finishing hours saved
$7933 + 500 = 8433$
7) Subtract new from old hours
$8433 - 3500 = 4933$
8) Multiply by $ value of man-hour $4933 \times \$4.30 = \$21,212$
or $21,000

Capacity — We have a further factor to consider — the cost of handling the 500 hrs of new large work in our shop vs. placing the work outside.

The investment calculation itself will account for the hourly cost of the machine, so we're concerned here only with a comparison of the out-of-pocket costs of doing this work inside or outside. The "value of the man-hour" includes the out-of-pocket costs or variable overhead costs caused by that man-hour. The only additional cost is for cutters and supplies which we estimate will be $2.00 per hour on this machine.

Outside cost for this work has been quoted at $20,000 annually. We will assume that the paper-work cost of purchasing outside will be the same as the cost of planning the operation for our own shop.

9) Calculate inside hourly out-of-pocket cost
$\$4.30 + \$2.00 = \$6.30$ hourly
10) Multiply by total hours
$500 \times \$6.30 = \$3150$
11) Subtract from outside cost
$\$20,000 - 3150 = \$16,850$
12) Add to previously calculated savings
$\$16,850 + \$21,000 = \$37,850$
or $38,000

The apparent savings from doing the new work inside may seem quite high, but don't forget our supplier must figure the cost of the machine in his quotation. Our machine cost is a part of the investment calculation.

The Investment Calculation

New machine installed cost	$200,000
Less market value old planer	10,000
Net investment	$190,000

13) Gross 1st year return
$\$38,000 \div 190,000 = 20\%$
14) Refer to Table
After tax return 11.5%

This will be a long-lived machine, an "off-standard" case from those that made up the standard "Rate of Return Table" we've been using. We can make an adjustment to our "rate of return after taxes" from the table "Adjustments for Off-Standard Cases" introduced in Chapter VIII.

15) Refer to "Off-Standard" Table for "long-life Machines"
$11.5\% + .5\% = 12\%$
Equivalent before tax Return 24%

Conclusion

Any general purpose machine tool with an after tax return of 8 or 10% should be a good investment for most shops. This machine would be a close candidate for investment even without the new additional size work. With the new work the return is excellent.

5 A $3,500 Belt Sander

Machines can replace hand methods as well as other machines. A finishing operation on 1000 annual units is being handled by hand scraping and burring at approximately 30 min/pc. A belt sanding machine will handle the same operation in 5 min, net.

Finding the Earnings

Where there is a limited and specified amount of work the calculation is easier.

1) Present hours
1000 pcs $\times$ 30 min $=$ 500 hrs
2) Proposed hours
1000×5 min $=$ 83 hrs
3) Hours saved
$500 - 83 = 417$ hrs
4) Multiply by $ value of man-hour $417 \times \$4.30 = \$1790$
5) Less annual cost of supplies (belts) $200
6) Net earnings $1590 **or $1600**

The Investment Calculation

New machine installed cost $3,500
7) Gross 1st year return
$\$1600 \div 3500 = 46\%$
8) Refer to Table
After Tax Return 28%

Once again, this is an "off-standard" case in that there is no old machine to lose market value if we **don't** replace. Also, this might very well be a short-lived machine. Referring to the off-standard chart, we deduct .5% for the short life and 1% for "No Present Market Value for Machines being Replaced."

9) Adjusted after tax return 26.5%
Equivalent before tax Return 53%

Conclusion

On the face of it, this seems like a better investment than the other examples, but it might not be. If the use of this machine is limited to this job, the earnings are more vulnerable to product design changes than with the other more general-purpose machines.

6 A $40,000 Single Spindle Chucking Automatic

Although deterioration is a significant factor in most replacement calculations, the old machines don't always have to be worn out. A shop has four 8-yr-old turret lathes working only one shift and still in good condition. Approximately half of the work can go on a newly available single spindle

chucking automatic even though lot sizes are only 50-100 pcs.

Find the Earnings

Obsolescence — Production estimates on several representative pieces indicate a production advantage of two for one. With allowance for additional setup time, overall production increase will be 75%. Since the machine is automatic, we can back it up with a drill press, and the operator will handle 500 annual hrs of second operations on the same work.

1) Add % increase to 1 — 1.75
2) Number of annual new machine hours — 2000
3) Equivalent "old" hours $2000 \times 1.75 = 3500$ hrs

Deterioration — Even though the turret lathes are in relatively good shape, there has been deterioration in 8 yrs. Tight tolerance jobs are causing some scrap and requiring extra care. In many little ways, the machines are not as productive as when they were new. We estimate that they are 90% as efficient as they were.

4) Present efficiency of old machines — 90%
5) Divide (3) by (4) to get total old hours $3500 \div .90 = 3890$
6) Subtract "new" from "old" hrs $3890 - 2000 = 1890$
7) Add hours saved because same operator will handle 500 drill press hours $1890 + 500 = 2390$
8) Multiply by $ value of man-hour $2390 \times \$4.30 = \$10,277$ **or $10,000**

The Investment Calculation

If we make the investment we will sell one replaced turret lathe.

New machine installed cost	$40,000
Less market value old machine	6,000
Net investment	$34,000

9) Gross 1st year return $\$10,000 \div 34,000 = 30\%$
10) Refer to Table

After tax Return	18%
Equivalent before tax Return	36%

Conclusion

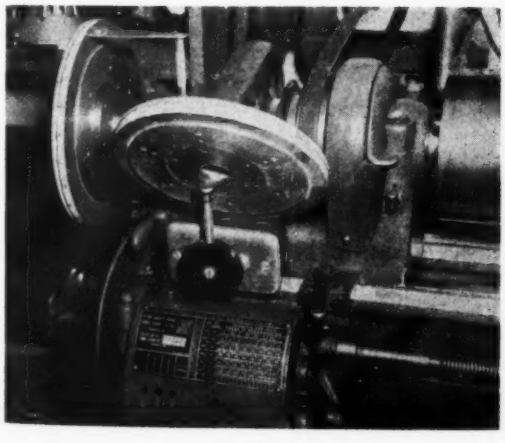
At this return, and because there is room for additional savings on a multi-shift basis with this general purpose tool, this is probably the best investment of any of these examples. ■

Make Your Own Dividing Head

One can rarely have all of the up-to-date machinery and equipment that's needed in the shop. Granted new machinery would save time and money, but the acquisition requires time and money. And there often exists a shortage of one or both of these elements. Stanley Brown, chief engineer at Duquesne Light Co., Pittsburgh, recently told us how they handled an equipment-time-money challenge in contriving an engine lathe dividing head.

Simple components, a couple of pieces of plywood and two steel tape measures, devised not a makeshift "lash-up" but a practical, rugged machine accessory. With it they can make instrument dials, micrometer feed dials, do some tool grinding, and perform many fluting and milling operations.

One tape, bearing 360 one-sixteenth inch divisions, was cut to exactly 22½", and another, bearing 200 one-eighth inch divisions, was cut to 25". A disc was cut from plywood to about 7.15 dia and fine-turned until the ends of the 360-division tape wrapped on the OD of the disc butted exactly. This operation was repeated for the 200-division tape, with a disc about 7.95 dia.



Quickly-made, but accurate, dividing head on its spindle adapter.

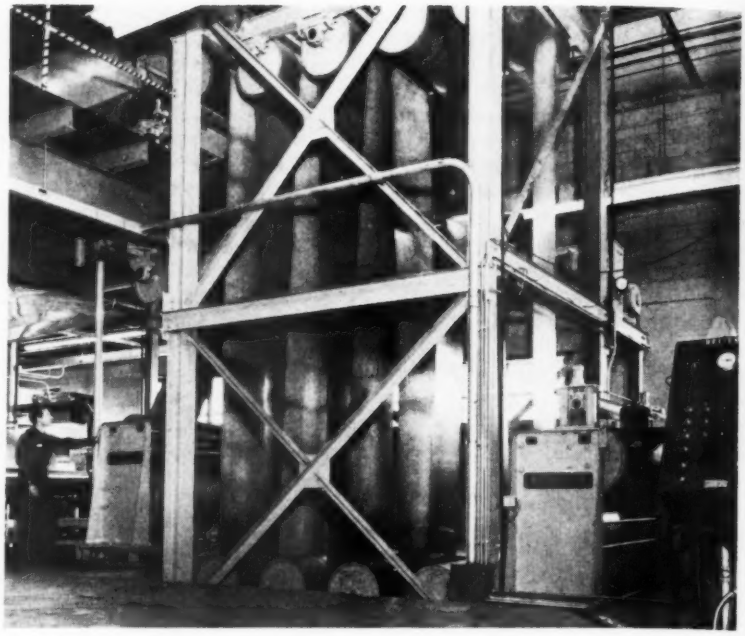
The tapes could be attached to the OD's of their discs in a number of ways. In this instance they were banded on with soft wire, which was then crimped.

As shown in the illustration, the disc used was secured to an adapter plate which was attached to the outboard end of the lathe spindle. The adapter was fitted with a scribed plastic "sight glass" for accurate reading of the graduated wheel.

We are always pleased to hear from our readers, especially in regard to techniques they have contrived to solve metalworking problems. If you have developed an interesting method of getting a job done more efficiently it could help others and be profitable to you. Send them in, and if we publish the innovation you will receive a check.

Innovation Editor
Huebner Publications, Inc.
1975 Lee Road
Cleveland 18, Ohio

Process with 1001 Features



One of the most efficient coil coating lines requires only minutes to feed a 10,000 lb coil from a pay-off reel through all cleaning, treating, and finishing and rewinding operations.

This 450 ft long unit is housed in an especially designed building at Pre-Finish Metals, Inc., 2111 East Pratt Blvd., Elk Grove, Ill.

The line can double coat coil stock up to 48″ wide and gages 0.0004 to 0.062. It can handle steel sheet 18 to 60″ wide and 4 to 12 ft long; gages from 0.012 to plate.

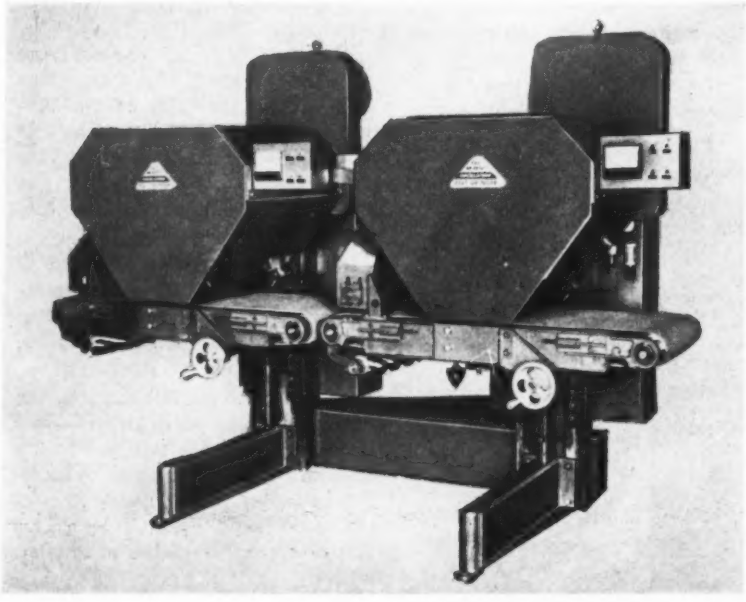
A seven stage cleaning and processing operation assures positive coating adhesion and continuity in the coatings. Peak capacity of the unit has not been established, but it's expected to surpass the initial output of 350 tons daily.

The company's pre-coated, preprinted and laminated sheets and metal coils are molded, die-cut, deep-drawn, stamped and punched into myriads of metal products that require no further finishing.

Company officials extol the virtues of pre-coating by pointing to lower finishing coats, better quality finish, added product sales appeal, greater design flexibility, faster production and various other benefits. Pre-finishing can be done on coils or sheets of electro-galvanized, hot-dipped galvanized, cold rolled or stainless steel, aluminum, magnesium, zinc, phosphor, bronze, and brass. Inform-A-Gram No. E6.

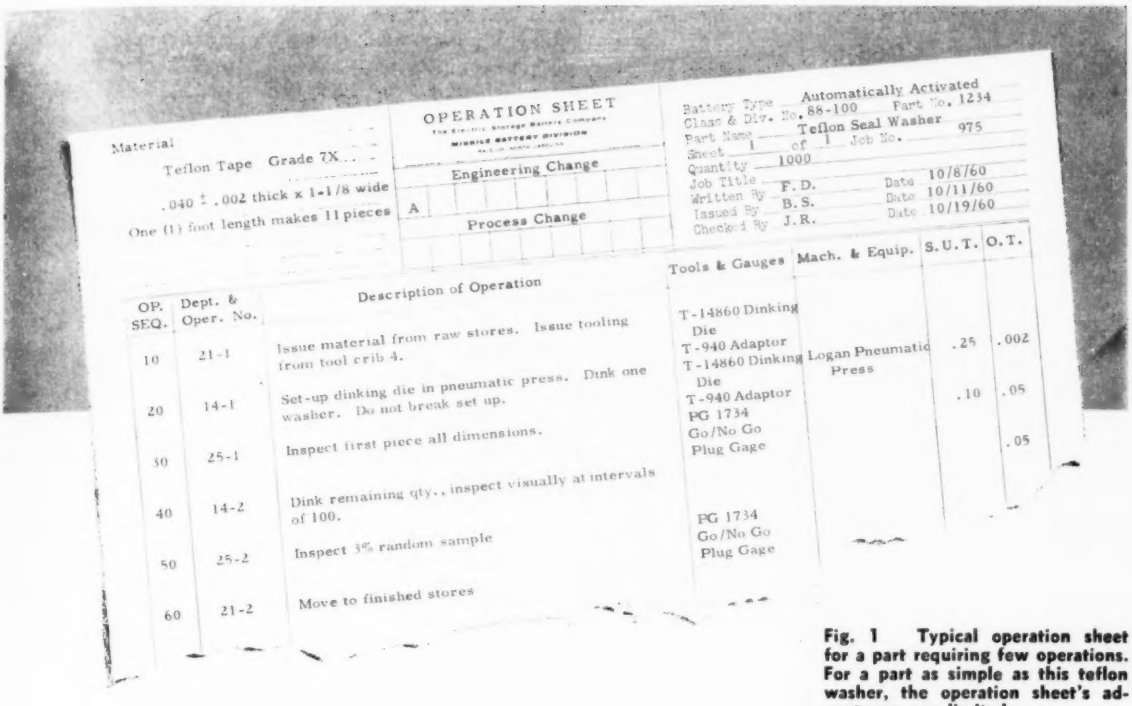
Tandem Adaptations

Two heads are better than one, and a minimum of special engineering has resulted in a tandem grinding setup at the Des Moines works of John Deere Co.



Rough and finish grinding is done in one pass by two 18″ Tri-Matic workheads. They're mounted in tandem. Controls for each workhead are installed individually on each machine to provide maximum flexibility of abrasive belt tension, speed, etc. Separate conveyors were used to avoid dust and dirt carry-over from rough to finish operation.

Tri-Matics have the standard features of controlled abrasive belt oscillation. They have separate wheels for abrasive belt driving, steering work, and contact. Setups are simplified. Work pressure is controlled by adjusting the knee on which the conveyor is mounted. According to Sales Service Mfg. Co., 2363 University Ave., St. Paul 14, Minn., any number of units can be arranged in tandem to do a series of operations. For additional information circle No. E7.



OPERATION SHEET

Material: Teflon Tape Grade 7X . . . .040 ± .002 thick x 1-1/8 wide. One (1) foot length makes 11 pieces

Engineering Change: A

Process Change

Battery Type: Automatically Activated
Class & Div. No.: 88-100 Part No.: 1234
Part Name: Teflon Seal Washer
Sheet 1 of 1 Job No.: 975
Quantity: 1000
Job Title: F. D. Date: 10/8/60
Written By: B. S. Date: 10/11/60
Issued By: J. R. Date: 10/19/60

OP. SEQ.	Dept. & Oper. No.	Description of Operation	Tools & Gauges	Mach. & Equip.	S.U.T.	O.T.
10	21-1	Issue material from raw stores. Issue tooling from tool crib 4.	T-14860 Dinking Die T-940 Adaptor			
20	14-1	Set-up dinking die in pneumatic press. Dink one washer. Do not break set up.	T-14860 Dinking Die T-940 Adaptor	Logan Pneumatic Press	.25 .10	.002 .05
30	25-1	Inspect first piece all dimensions.	PG 1734 Go/No Go Plug Gage			.05
40	14-2	Dink remaining qty., inspect visually at intervals of 100.				
50	25-2	Inspect 3% random sample	PG 1734 Go/No Go Plug Gage			
60	21-2	Move to finished stores				

Fig. 1 Typical operation sheet for a part requiring few operations. For a part as simple as this teflon washer, the operation sheet's advantages are limited.

Transition From ? Memory To Method

by John Reifel

Mr. Reifel is a tool engineer at the Missile Battery Division of The Electric Storage Battery Company, Raleigh, N.C.

LARGE MANUFACTURING FIRMS have recognized the value of the operation sheet* for many years. It would be impossible to coordinate the different functions of the organization without this form of control.

The problem confronting many, however, is associated with the "growing up" of a small organiza-

*Variation in shop terminology justifies our mentioning that "operation sheet" is sometimes called "process sheet," and when it gets to the shop level is quite commonly called the "routing sheet."—Ed.

tion. The key people in a small plant function in a variety of jobs. The smaller operation can be run from memory; the owner, the foreman, and the machine operator can see the entire picture in much the same perspective, and we have an efficient organization.

It's the expansion, the greater division of responsibility—in short, the step from the informal "memory" organization to the coordinated, more formalized unit that requires the operation sheet.

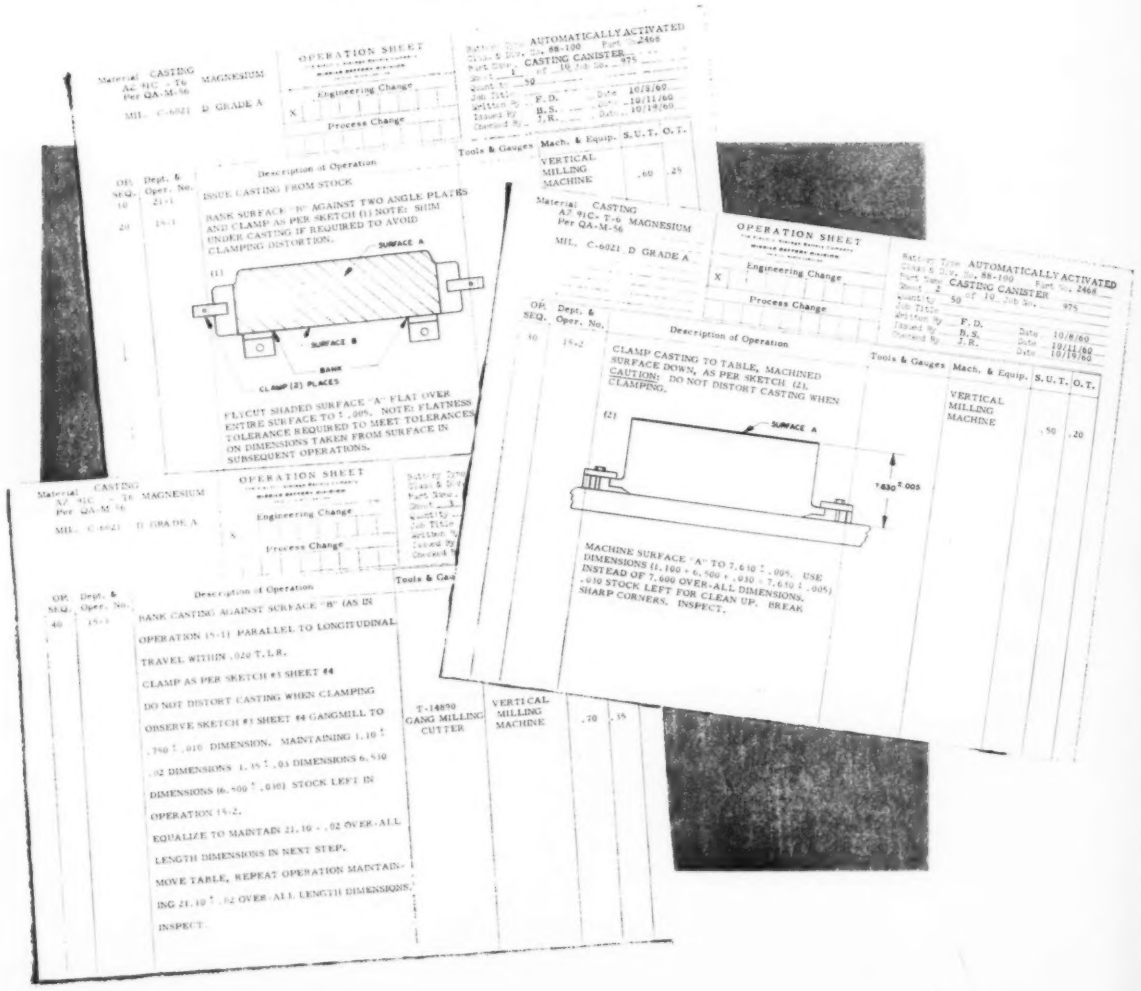
After product designs have been received in the manufacturing engineering dept., detail and assembly drawings are studied by the methods engineer for manufacturing feasibility and sequence. At this stage, recommendations are made to the design engineering dept. for changes which will simplify tooling and production, and result in a better or less costly product.

The importance of this first step cannot be over-emphasized. A change to a more machinable or less costly material, a stamping or precision casting could save considerable time and money. The logical time to make revisions to avoid costly expense and confusion is before purchase of materials and equipment, and layout of the production line. It is cheaper to erase lines than to machine surfaces.

Because of the inconspicuous way duplication occurs in parts handling, management is usually not aware of it. Inspection operations are especially apt to fall into this area because the part itself does not show physical evidence of inspection. The methods engineer should consider the kind of operation and the tooling to determine whether a part requires first-piece sampling or 100% inspection. The inspection method and the critical dimensions are specified on the operation sheet. This eliminates the possibility of duplication.

For example, let's methodize a teflon washer. The methods engineer has to determine how to make

Fig. 2 A more complex part like this canister brings up some special problems, which the operation sheet helps to avoid. Shown here is a composite sheet for only the first few operations, to illustrate the pattern in which information is presented.


OPERATION SHEET
Material CASTING
Al. SIC - T6 MAGNESIUM
Per QA-M-56
MIL. C-6021 D GRADE A
Engineering Change
Process Change
AUTOMATICALLY ACTIVATED
CASTING CANISTER
Part No. 2468
Op. No. Dept. & Oper. No. Description of Operation
Tools & Gauges Mach. & Equip. S.U.T. O.T.
10 21-1 INSIDE CASTING FROM STOCK
VERTICAL MILLING MACHINE .60 .25
20 15-1 BANK SURFACE "B" AGAINST TWO ANGLE PLATES AND CLAMP AS PER SKETCH (1) NOTE: SHIM UNDER CASTING IF REQUIRED TO AVOID CLAMPING DISTORTION.
SURFACE A
SURFACE B
BANK
CLAMP (2) PLACES
FLYCUT SHADED SURFACE "A" FLAT OVER ENTIRE SURFACE TO ± .005. NOTE: FLATNESS TOLERANCE REQUIRED TO MEET TOLERANCES ON DIMENSIONS TAKEN FROM SURFACE IN SUBSEQUENT OPERATIONS.
OPERATION SHEET
Material CASTING
Al. SIC - T6 MAGNESIUM
Per QA-M-56
MIL. C-6021 D GRADE A
Engineering Change
Process Change
Op. No. Dept. & Oper. No. Description of Operation
Tools & Gauges Mach. & Equip. S.U.T. O.T.
40 15-3 BANK CASTING AGAINST SURFACE "B" AS IN OPERATION 15-1) PARALLEL TO LONGITUDINAL TRAVEL WITHIN .020 T.I.R.
CLAMP AS PER SKETCH #3 SHEET #4
DO NOT DISTORT CASTING WHEN CLAMPING
OBSERVE SKETCH #3 SHEET #4 GANGMILL TO .750 ± .010 DIMENSION. MAINTAINING 1.10 ± .02 DIMENSIONS 1.35 ± .01 DIMENSIONS 6.510 DIMENSIONS (6.500 ± .010) STOCK LEFT IN OPERATION 15-2.
T-14890 GANG MILLING CUTTER
VERTICAL MILLING MACHINE .70 .35
EQUALIZE TO MAINTAIN 21.10 ± .02 OVER-ALL LENGTH DIMENSIONS IN NEXT STEP.
MOVE TABLE, REPEAT OPERATION MAINTAINING 21.10 ± .02 OVER-ALL LENGTH DIMENSIONS.
INSPECT.
OPERATION SHEET
Material CASTING
Al. SIC - T6 MAGNESIUM
Per QA-M-56
MIL. C-6021 D GRADE A
Engineering Change
Process Change
AUTOMATICALLY ACTIVATED
CASTING CANISTER
Part No. 2468
Op. No. Dept. & Oper. No. Description of Operation
Tools & Gauges Mach. & Equip. S.U.T. O.T.
10 21-1 INSIDE CASTING FROM STOCK
VERTICAL MILLING MACHINE .60 .25
20 15-2 CLAMP CASTING TO TABLE, MACHINED SURFACE DOWN, AS PER SKETCH (2). CAUTION: DO NOT DISTORT CASTING WHEN CLAMPING.
(2)
SURFACE A
7.610 ± .005
MACHINE SURFACE "A" TO 7.610 ± .005. USE DIMENSIONS (1.100 + 6.500 + .010 = 7.610 ± .005) INSTEAD OF 7.600 OVER-ALL DIMENSIONS. .010 STOCK LEFT FOR CLEAN UP. BREAK SHARP CORNERS. INSPECT.

it—should it be made from bar stock or sheet? If both are available — the sheet in the proper thickness and the bar in the right diameter — he must determine whether his plant has equipment to blank the part from sheet or machine it from bar, whether product specifications will be met by both or only by one method of manufacturing, and which would provide the lowest unit cost. If the needed quantity is great, perhaps the purchase of equipment can be justified.

The method of manufacture and usually the kind of equipment to be used are noted on the operation sheet, as is the amount of material necessary to produce the quantity required. Any stock dimensions that are critical to efficient use of tooling are also specified.

The next step is to specify the required operations on the sheet in sequence (see example). This ties together the department, the operation, and the tooling required at each step. The estimated setup time (S.U.T.) and operation time (O.T.) is entered, and the operation sheet is ready for release.

Upon completion of the operation sheet, the methods engineer initiates the purchase or design of tooling required for the part.

The operation sheet is duplicated and released to the various departments concerned with the information it contains. From the estimated setup and piece part time, the planning and scheduling dept. establishes the machinery workload, and the time required to complete the run. From its copy, the material control dept. orders the proper size, quantity, and type of material required. Upon release of the job to manufacturing, the operation sheet travels with the job, indicating tooling, setup, and procedure required at each station.

After release of an operation sheet, setup and manufacturing times often are re-evaluated at the job station to give an accurate documentation of actual time. The operation sheet can then be modified for more accurate guidance on a repeat run. A process that proves unsatisfactory can be analyzed and changed before another job is run, provided it was originally recorded. In the absence of the operation sheet, we have to rely on memory, and consequently often have inaccurate information.

The operation sheet is invaluable in the cost estimating of new jobs with similar or identical components. It establishes definite costs, and limits or eliminates tooling duplications.

The teflon washer is a simple part, and only gives a general idea of the functions performed by the operation sheet. A part that requires operations performed in several departments is virtually impossible to manufacture without using the operation sheet.

A canister casting illustrates how the operation sheet is applied for a part of greater complexity. Operation 15-1 calls for (shaded) surface "A" to be flat within 0.005 over entire surface. This need is not apparent from the part drawing (not shown) until dimensions can be taken from this surface to later machined surfaces.

Operation 15-2 deviates from the drawing, allowing 0.030 stock for a later operation. All dimensions taken from this surface must therefore include the 0.030 until they arrive at the operation where the 0.030 is removed from surface "A". Without the control provided by operation sheets, drawing deviations for manufacturing operations could be easily overlooked. For example, a dimensional deviation may be required for a milling operation, but would not be known to the foreman or machinist on a preceding lathe operation.

Perhaps the tolerance on screw-clearance holes in a part is +0.015. Functionally this may be adequate. However, two of the holes may have to be drilled and reamed to closer tolerance to provide accurate locating points for subsequent operations. In the small shop we might rely on memory for this kind of condition, but this is a precarious, and sometimes an expensive premise.

Process controls for any military application, and controls called out by specifications developed internally, appear on most part drawings used today. The production foreman or leadman usually does not have all the information required to interpret these specifications. The operation sheet interprets such specifications only to the extent they pertain to specific operations.

The greater the dependence upon unrecorded knowledge, the greater the risk. If the employees whose memory has been depended upon should leave the organization, much time and money can be lost in redetermining methods. Formalize procedure; don't depend on memory. This is the basis for efficient operations of the modern manufacturing plant, regardless of size, and the operation sheet is a key factor in achieving efficient functioning. ■

Numerical Control In Assembly Work?

It's conceivable, according to officials of Gilman Engineering & Mfg. Co., a subsidiary of The Parker Pen Co.

Gilman spokesmen said at a recent gathering in Janesville, Wis., that "there conceivably will be a growing place for numerical control in automatic assembly." They likened the operation to that of transfer type machine tools, of which at least one machine already has been developed to operate under tape control.

". . . tape-controlled assembly machines can and will be developed to handle relatively short runs of somewhat similar assemblies, or a combination of these. Such machines are apt to represent a fairly high investment because of the versatility that would have to be built into them. But it is this very versatility that could make them economically practical, and which, combined with tape control programming, would bring about the advantages associated with numerical control of other classes of equipment."

Tufftriding 'Testimony' Grows

Data continues to collect in support of the versatility and economy of Tufftriding, the West German-developed tool and parts-treating process recently introduced to the U.S. by Kolene Corp., Detroit, Mich.

Because it forms nitrides at the surface of ferrous metals, Tufftriding is classed as nitriding, but the similarity ends right there, according to the Detroit firm. Since Tufftriding is done to accomplish entirely different results, standard tests for nitrided parts (hardness and case depth) are of no importance, say Kolene officials.

Fig. 1 Special fixtures help loading of diesel engine crankshafts before treatment.

The molten salt bath process has been adopted so far to: increase fatigue resistance of hydraulic components, avoid galling of airplane landing gear parts, increase service life of punches and dies, extend life of automotive crankshafts, almost triple forging die life, prevent cracking of high-compression cylinder heads, and permit replacement of costly steels in some parts.

Typical of the results being scored with Tufftriding are those portrayed in Figures 1, 2, and 3. The service life of an SAE 1046 diesel engine crankshaft, Fig. 1, has been lengthened by Tufftriding at 1050° F for 150 min. Life of the parts is now 70% longer before fatique.

Compared after actual operation, Fig. 2, Tufftrided camshafts show a big improvement over case-hardened shafts. The 0.16 carbon, 1.20 manganese 1.00 chrome shafts were "driven" more than 62,000 miles. The case hardened parts show excessive gear wear, and a pronounced fatique pattern on the cam.

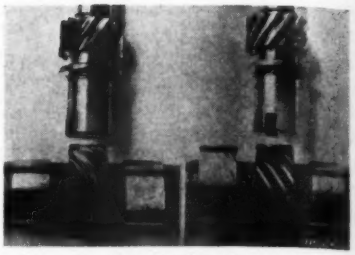


Fig. 2 Case-hardened camshaft (left) compared with Tufftrided camshaft after 62,000 miles.

Tools can also profit from the process. Fig. 3 shows an M-2 HSS thread-cutting die that has been Tufftrided. Since treatment, its time between sharpenings is only slightly less than that for tungsten carbide.

For more information on this process that can be applied to mild,

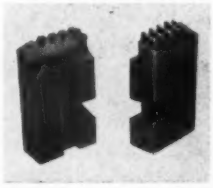


Fig. 3 Performance of M-2 HSS thread-cutting die approached that of tungsten carbide.

stainless and alloy steels, and also to cast irons, write to Kolene Corp., 12890 Westwood, Detroit 23, Mich., or circle Inform-A-Gram No. E8.

QUITE A SHOW!

The American Society for Metals presents its 43rd National Metal Congress and Exposition in Cobo Hall, Detroit, Monday through Friday Oct. 23-27. Nine participating societies will help ASM welcome the 30,000 metalworking executives, design, product and metallurgical engineers, production, purchasing and sales personnel who are expected to register. More than 275 exhibits, 200 technical papers, and a dramatic materials comparison center will be offered registrants.

Technical emphasis will be on metals, materials and their related processes, tooling and general metalworking. Participating societies are: American Society for Metals (sponsor), American Gas Assn., American Welding Society, Industrial Heating Equipment Assn., Metallurgical Society of AIME Metal Powder Industries Federation, Metal Treating Institute, Special Libraries Assn., Society for Nondestructive Testing, Ultrasonic Manufacturers Assn.

TOOLING & PRODUCTION editors have selected a number of products that will be shown and should be of interest. You will find them on the regular "Product News" pages with the ASM Show symbol for identity. Symbols of all participating groups are on this page.

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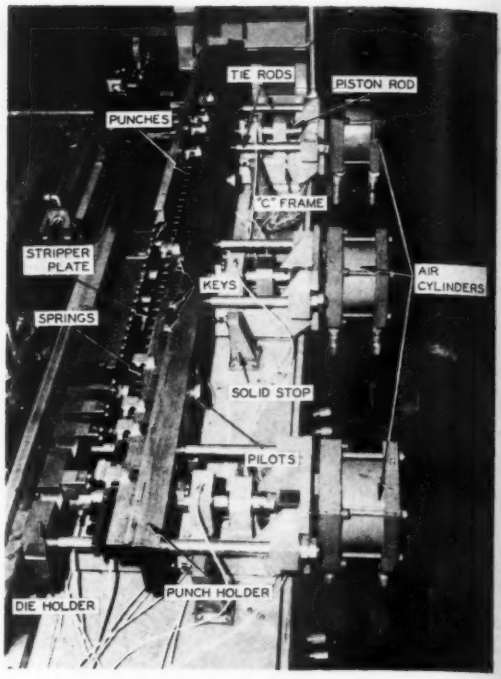

Fig. 1 Over-all view looking down on the press tooling that solved a setup problem.

A LARGE APPLIANCE MANUFACTURER has been relieved of a knotty metal punching problem by using some rather ingenious tooling. Components for freezer doors require punched holes for the lock, the trim, etc. Various models have to be accommodated. All use the same basic door part, but each requires a different hole pattern. This posed a serious problem, suggesting many setups and unusual tooling expense. The situation was further aggravated by the location of the holes in the bottom of a rather deep channel section.

Designers at National Electric Welding Machines Co., Bay City, Mich., attacked the problem with one horizontal die (Fig. 1) to do all jobs. Punch patterns are controlled by the arrangement of a row of keys that back up the array of punches. For a given hole pattern, keys are inserted behind the desired punches. When the "press" operates, keyed punches penetrate the workpiece, while the unneeded punches are merely pushed back on contact with the workpiece. They reprogram the keys to achieve a different hole pattern. All other setup and tooling is virtually eliminated.

Another feature of this press is the application of the pneumatic equalizing principle often found on resistance welding guns. Because of the cross-sectional configuration of the workpiece, it was desired to have the die move into the "floor" of the workpiece channel, as the punch approaches from the opposite direction (Fig. 2, top). The result could be called a "full-floating action," in that when the air cylinder is actuated the die is pulled toward the workpiece, where it meets an adjustable stop. The continuing stroke then causes the punch to do its work (Fig. 2, bottom).

The air cylinder is fixed to one end of a "C" frame. The punch holder is free of the "C" frame (affixed to the piston rod and held in line by the tie rods) and the die holder is fixed to the other end of the frame.

The job is done quickly with just one unit in place of many suggested at first look. ■

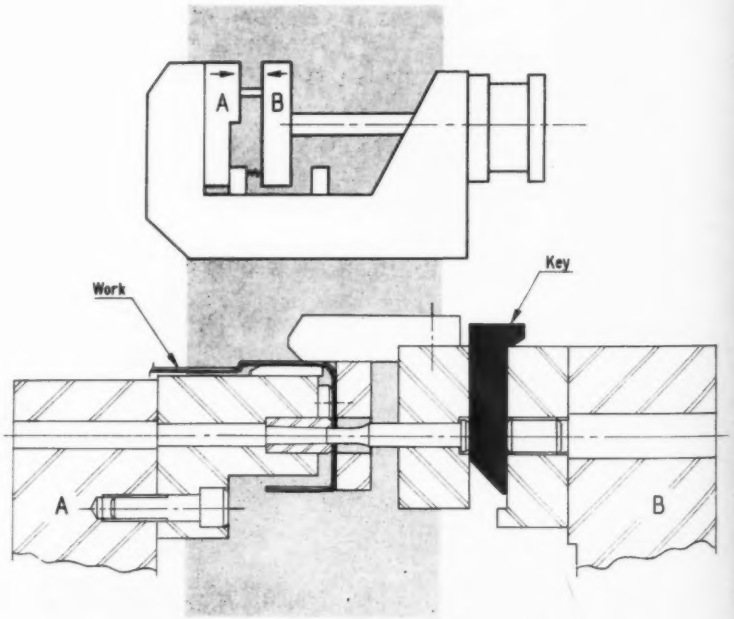

Fig. 2 Pneumatic equalizing principle symbolized, top. Bottom is a sectional view through A and B, above, showing punch, backed by key, penetrating the work.

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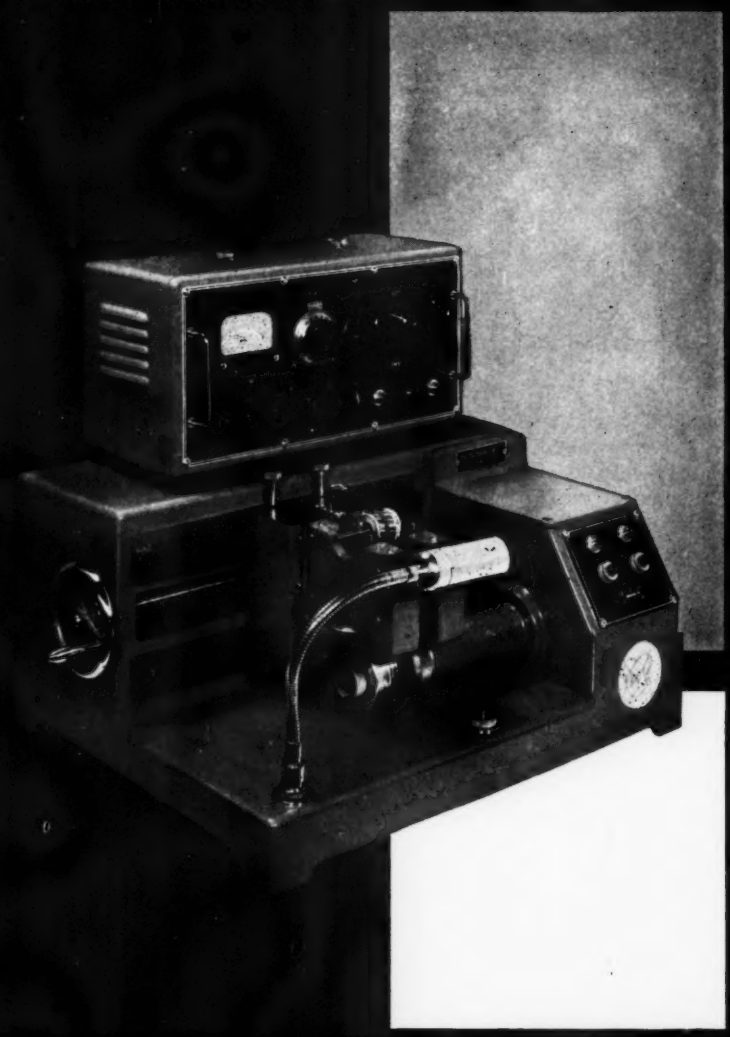

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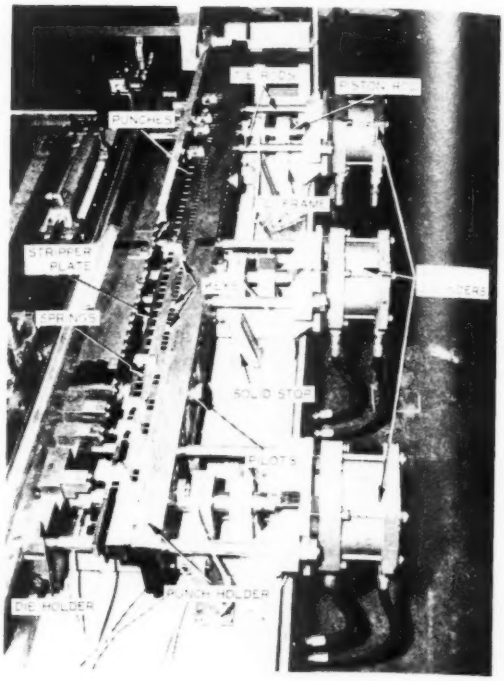

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The air cylinder is fixed to one end of a "C" frame. The punch holder is free of the "C" frame (affixed to the piston rod and held in line by the tie rods) and the die holder is fixed to the other end of the frame.

The job is done quickly with just one unit in place of many suggested at first look. ■

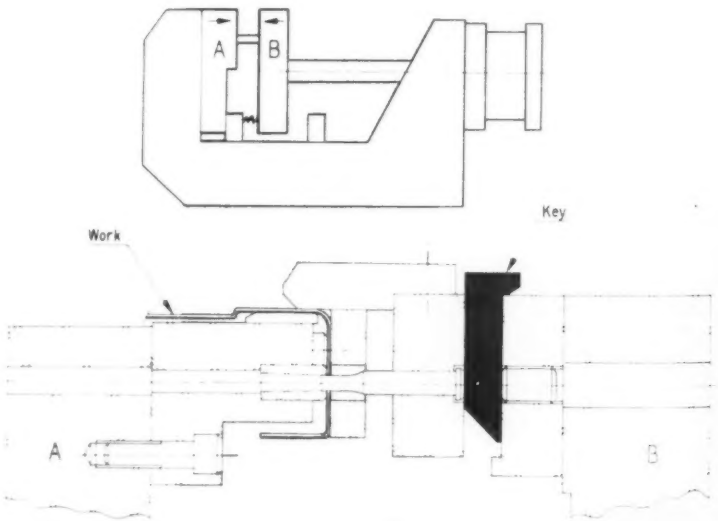

Fig. 2 Pneumatic equalizing principle symbolized, top. Bottom is a sectional view through A and B, above, showing punch, backed by key, penetrating the work.

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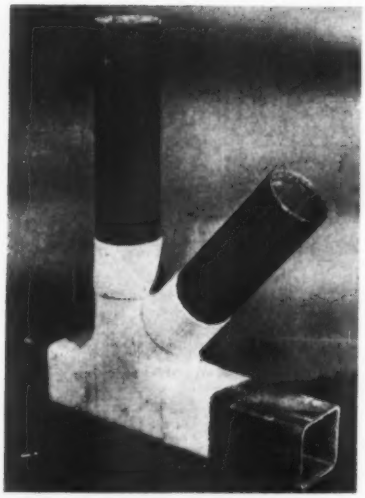


Fig. 1. Cutaway of typical laminated plastic tubing joint used to support structures for fixtures and models.

Helpful Hints Toward Repairing Plastic Tools

by William A. Lawry

Mr. Lawry is director of technical services, Ren Plastics, Inc., Lansing, Michigan.

PLASTIC TOOLS, unlike those made of metal, are essentially strain-free structures. If a structural member is to be added to a plastic tool, addition is accomplished by bonding the new member into place with epoxy paste that sets at room temperature. Distortion of the surrounding frame is eliminated, because no strain is added to the frame by bolts or machining, and no heat is required as in welding.

The following suggestions will be helpful in the successful repair or modification of plastic tools:

1. Repair a tool with the materials from which it was originally developed, when possible, to avoid variations that might develop because of differences in physical properties.

2. When a surface coat is to be built up with laminations or cast resin, grind or rough-up the area to be repaired, (Fig. 3), and wet the area with a laminating material to assure a good bond between the surface and the next application of plastic.

3. When metal is to be bonded to plastic, use mechanical keying-in devices such as cap screws, (Fig. 4), interlocking keys, etc., to assure permanence.

4. When working against a mold or model, be sure the surface is in good condition and that a proper parting agent is used. If the quality of the mold or model surface is poor, it follows that the tool surface may also be below par.

5. Post-cure for 6 to 8 hrs at temperatures 40° to 50° F above the expected operational temperature of the tool. The increased strength and stability offered by high-heat post-cure insures against possible mishaps when reworking.

6. Be sure to use quality materials and tested methods when

Fig. 2 All plastic auto roof checking and routing fixture.

repairing production tools. The cost of inferior materials can easily wipe out the savings originally gained.

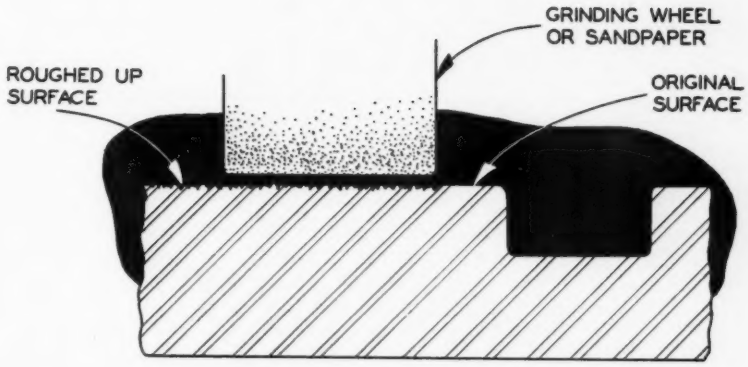
7. Do not try to speed up the cure by applying too much heat in local areas, since this can induce shrinking and warping. Local application of a little heat (up to 120° F) may be applied to small (one or two inch) repairs.

8. Bushings should not be "press fitted" into plastic tools, since this may result in a quickly loosened bushing. A row of them can cause a plastic surface to warp.

9. Always normalize a steel weldment before attaching it to a plastic faced tool.

10. Do not allow long lengths of metal to be in constant contact with cast plastic. There's a different co-efficient of thermal expansion for plastic and metal. ■

Figure 3



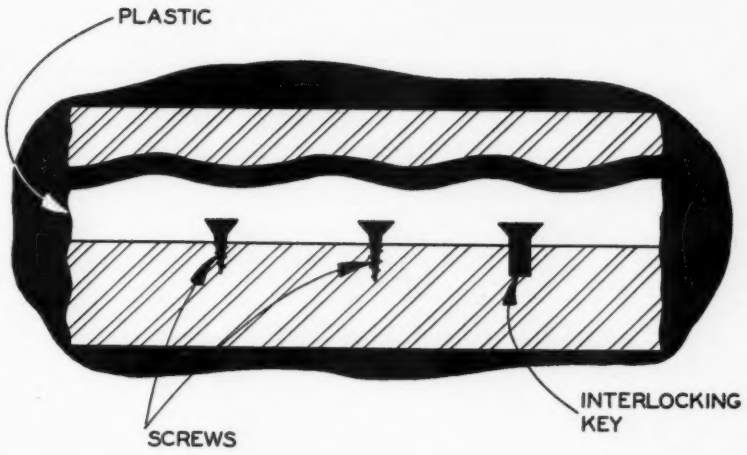


Figure 4

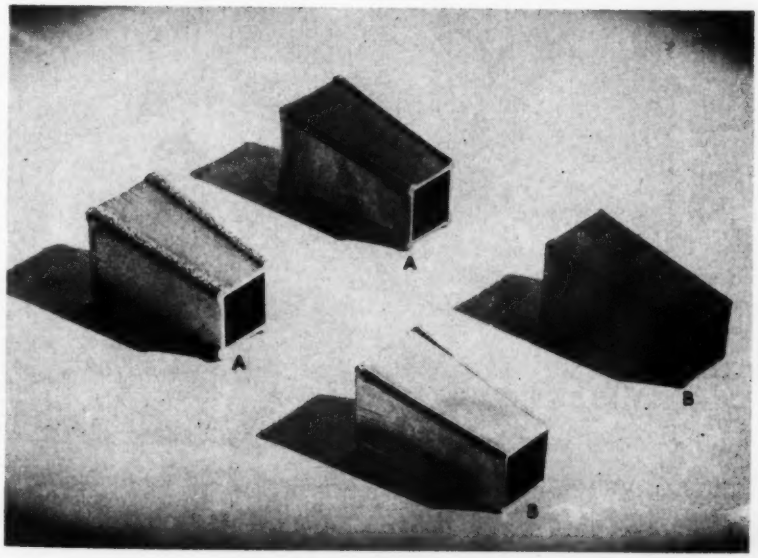
Smoothing the Rough Edges

Secondary machining of electroformed copper and nickel parts has been eliminated at the Melpar Research Div., Westinghouse Air Brake Co., Falls Church, Va.

Electroform plating is usually reserved for the creation of one-piece shapes or surfaces not easily formed by other means. One problem in the process has been the unduly heavy deposit of metal at the part's outside edges, where current density is greatest.

By using additive agents in the electroforming bath in combination with economical "thieving" and "shading" techniques, the Melpar process virtually eliminates costly machining on the outside of the part, except where extremely fine tolerances have to be met. Thus, Melpar has been able to greatly improve the uniformity of the deposit's thickness, and has reduced part costs.

Parts labelled "A" were conventionally electroformed from copper and nickel. Those labelled "B" are their Melpar formed counterparts.



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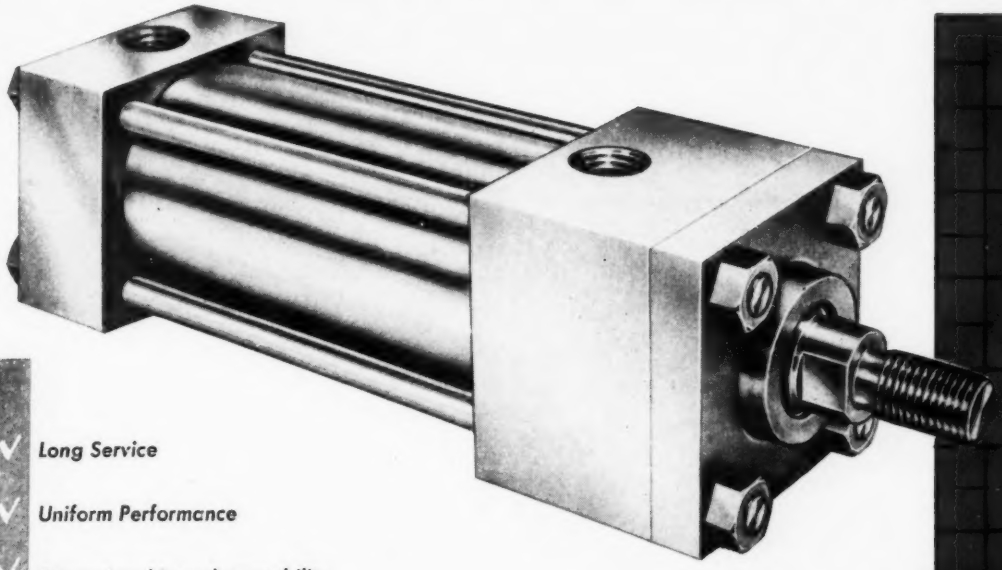

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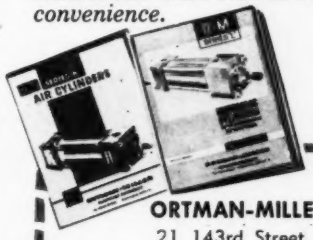

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CIRCLE INFORM-A-GRAM KEY NO. 69

Compressed Air Efficiency Checklist

Plate edge dressing by grinder using maximum air pressure shows "healthy" spark pattern.

PEAK PERFORMANCE OF PNEUMATIC tools is possible only when proper air pressure is available *inside* the power tool. Many factors can reduce available pressure at the tool.

While other features like proper tool size, proper abrasive and shape of wheel are important to production, your best tools operate at a severe disadvantage when starved for air. Today's pneumatic tools are designed for operating pressures of 90 psi. If the air pressure delivered to the tool drops to 45 psi, operating efficiency is only 50%. This happens — it is not unusual. To avoid this costly production loss, consider the boxed checklist.

Air is stored at the compressor with its associate equipment, and receiving tank. This is a rare trouble spot. Most plants have adequate compressor capacity. If not, a small booster compressor and receiver will usually suffice to help out during periods of peak load, thus avoiding the major expenditure of installing a larger unit.

Remember! The important thing is the pressure that gets *inside* the tool during full load. It is difficult to check pressure at this point, but it is easily measured at the tool's inlet end. A needle gage inserted close to the inlet coupling will give you the answer. However, your reading will not include pressure loss through the last coupling.

A better method is to use a pressure gage on a pipe tee connected to the inlet end of the tool. If your reading is less than 90 psi, you're not operating at peak efficiency.

If your readings are under 70 psi, a serious loss is indicated. Get busy with the checklist.

But if you can measure 80 psi at most of your tools, you are more fortunate than most. ■

COMPRESSED AIR EFFICIENCY CHECKLIST

√ Pneumatic Tools

1) Is the tool of proper size? For example, don't operate a 6 or 8" grinding wheel on a high-speed light-duty machine.

2) Is the tool in good operating condition? Trouble spots include clogged or dirty air strainers, deposits in the motor, worn rotor blades and cracked machine housings.

3) Is the tool running at proper speed? A faulty governor can cause speed loss, or excessively high speed. Using a tachometer, periodic speed checks should be made to determine governor problems.

√ Hose Connections

1) Is the proper size connection being used? An undersized nipple at the air tool can rob you of 8 to 10 psi. Never use a reducing bushing to accommodate a smaller connection on the hose.

2) Are quick connect couples "choking" your air supply? While convenient to use, some will restrict air pressure delivered to the tool.

√ Air Hose

1) Is the hose of proper size? It should be at least one size larger than the tool's threaded inlet. It should never be less.

2) Is the air hose too long? Air power is lost through friction as the air travels the hose's length. Don't use a 50 ft hose where 25 ft will do. Hose lengths can be kept to a minimum at permanent work stations.

3) Does the hose leak? Cuts and cracks can be a serious pressure drain.

4) Has the hose been repaired too often? Each repair connector adds another restriction to your tool's air supply.

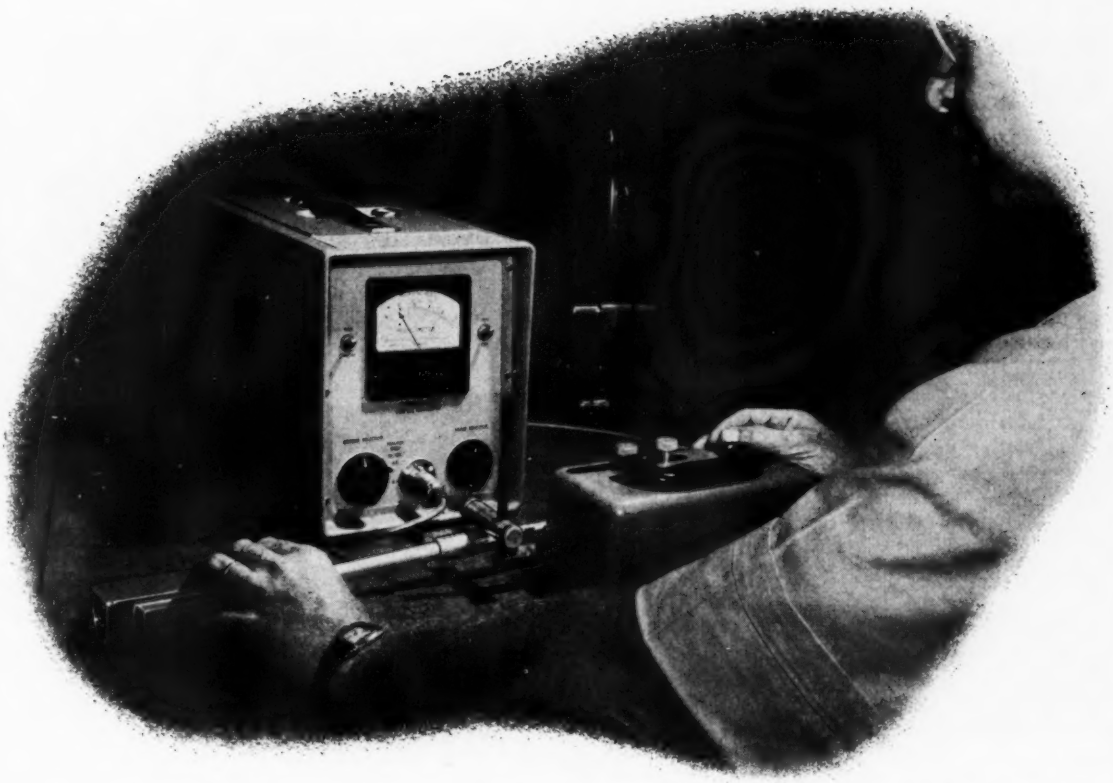
√ Mains and Drops

1) Are drops and mains of proper size? This is as important as hose size. Check your mains and drops to determine how many tools each will handle. Remember! You may not be able to run one more heavy-duty grinder from a drop that will accommodate three or four die-grinders.

2) Are all outlet valves and connections tight? Air leakage at threaded connections is common, but easily remedied.

3) What is the condition of the piping? Several years of accumulated rust, scale, sludge, etc. can clog an otherwise adequate piping system. If you replace piping, or are putting in a new line, it will pay to consider a size larger.

4) Is your piping system equipped with air filters and lubricators? They are of tremendous value to remove moisture and dirt from the line and to keep your tools oiled.



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How do they do it? By maintaining close tolerance accuracy, using top quality high speed steel stock, and producing a complete drill line on their own machines to hold costs in check.

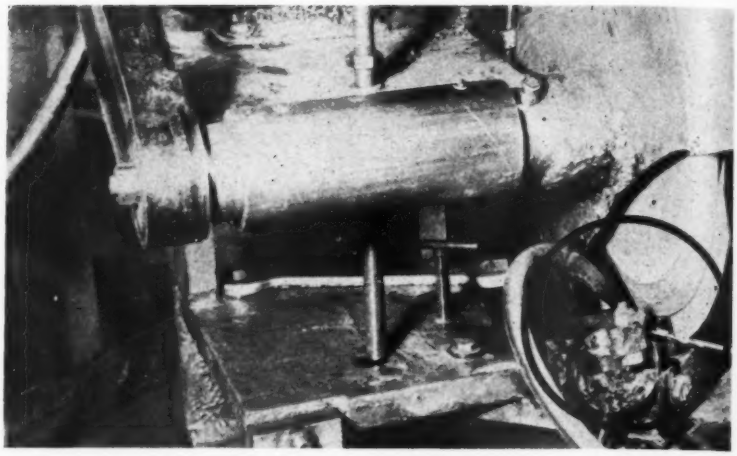
In determining how best to make twist drills, the company decided that precision grinding from solid for the smaller drill sizes, using special high speed steel bar stock with special heat treating, would produce the best quality results. By making their own grinding machines, they felt they could save equipment investment, too.

For their machines, they required a spindle that would provide as much precision and accuracy as wanted in their drills. The spindle, they then specified, must have no end play and have long maintenance-free life. After several tests, the Dumore Quill, Model 7X-250, was chosen as the best for their purposes.

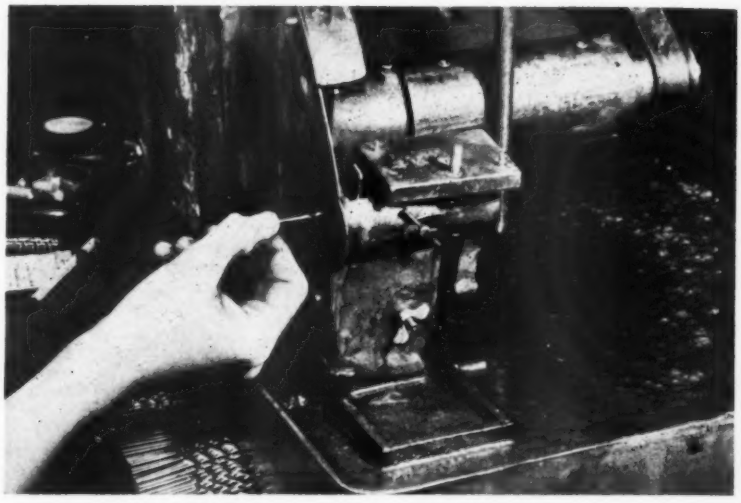
A total of 57 Dumore spindles are used. In the special machines, 36 are used for flute grinding, 2 for special slotting and grinding, 2 for bar stock cutoff operations, and 7 for relief grinding. Ten are on standby for replacement when repairs become necessary.

Precision modifies the standard spindles to facilitate their manufacturing procedures. Flanges are sweated onto the wheel end, to rigidly hold the various thin grinding blades. Oil cups are added in place of oil eyes to speed location of lube points by operators.

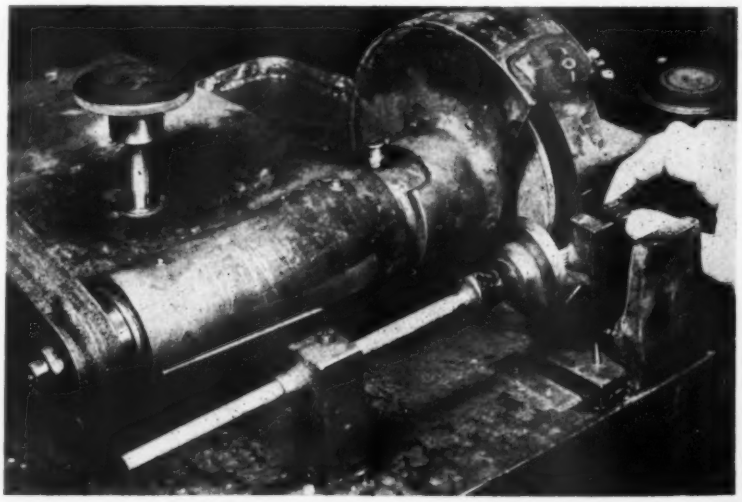
If you'd like to know more about Dumore Quills and how they can fit into your future, write to The Dumore Company, 1300 — 17th St., Racine, Wisc., or Circle Inform-A-Gram No. E9.



Special drill-flute grinding machine developed around the Dumore spindle. Hardened barstock blank is fed mechanically to the wheel for fluting from the solid. Machine automatically reverses between grinding first and second flutes.



For grinding drill relief, stock is hand fed through a collet to the wheel. Change of collet and wheel adapts machine for various size drills.



Cutoff of drill blanks is also done on special machines using spindle units equipped with thin abrasive wheels. Smallest-diameter blanks are cut off in multiple.

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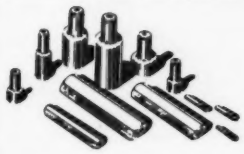

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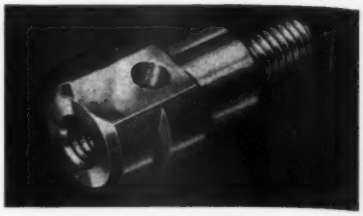

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CIRCLE INFORM-A-GRAM KEY NO. 744

metalworking management is only as effective as the foremen who translate its objectives into efficient production. A Washington, D.C., management consultant, Dr. Robley D. Stevens, offers the following checklist as a means for management to rate foremen in eight critical categories.

This "yardstick" might be a useful one to apply to candidates for the foreman rating, or it might serve as a helpful one in evaluating your present team. Ask yourself these questions about the foreman or prospective foreman:

A 'Yardstick' for Rating Foremen

Understanding The Organization

Does he . . .

Understand the functions of his department and how they contribute to the total program of your company?

Show each employee how his job fits into the over-all picture?

Know how to determine his supervisory lines of authority and responsibility?

Determine number and type of employees required in his department?

Make a logical assignment of employees based on a clear outline of his authority and responsibility?

Getting The Work Out

Does he . . .

Give instructions that are clear, understandable, and specific?

Review the work of his own department?

Coordinate the work in his department?

See that employees do what is required of them?

Emphasize the control of cost?

Minimize the necessity of overtime work?

Resolve his production problems quickly?

Planning And Scheduling

Does he . . .

Keep up with the department workload?

Assign priorities to work and schedule proper attention?

Plan for better use of manpower, equipment and space?

Set realistic goals for employees?

Encourage employees to do more?

Plan to meet deadlines and emergencies?

Working Methods

Does he . . .

Analyze his department operations?

Evaluate present methods of performing work?

Develop and apply improved methods?

Place employees where where they are most effective?

Performance Requirements

Does he . . .

Decide what is expected of each person?

Determine work requirements based on department needs?

Evaluate objectively each person's performance?

Schedule work in department in proper sequence?

Development of Employees

Does he . . .

Select right person for right job?

Help personnel adjust on new jobs?

Determine training needs of employees?

Recommend on-the-job training?

Let each employee know how he is doing on job?

Discuss career opportunities?

Develop a good understudy?

Cooperative Work Force

Does he . . .

See that personnel are rewarded for jobs well done?

Commend entire group on performance when deserved?

Transfer and reassign employees for best use of their abilities and experience?

Have confidence and loyalty of his workers?

Adjust employee grievances objectively?

Keep employees informed of company policies?

Stress safe working habits?

Maintain effective discipline?

Hold down production costs?

Maintain quality standards?

Self Improvement

Does he . . .

Recognize his shortcomings?

Improve his technical knowledge and skill?

Strive to get along with people?

Develop a cooperative attitude toward his own job?

Seek or avoid responsibility?

Keep abreast of new developments?

Work well under pressure?

Accept constructive criticism?

Do a full day's work?

Like to supervise?

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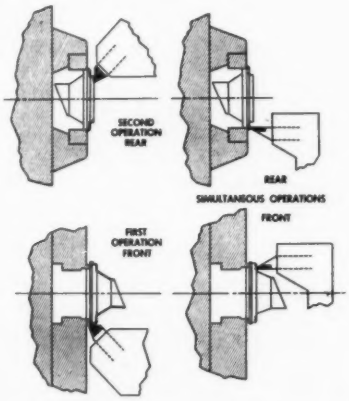

The Model 308 cam-operated precision boring machine is built by Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. The unit is ideal for producing multiple diameters and contours to close tolerances. Tool motions are controlled by accurately ground cams. Repeatability is assured. Cam followers for both table and cross slide engage directly without any intermediate levers or linkages. For more information circle Inform-A-Gram No. E3.

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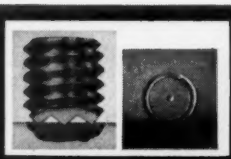

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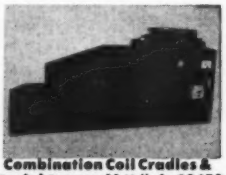
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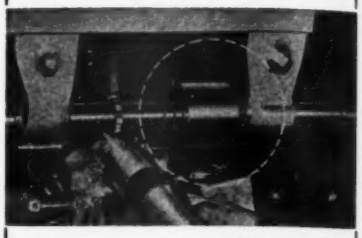

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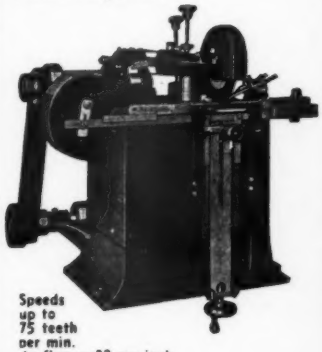
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2000 Jobs Lost to Imports

Tool steel imports from Europe, Japan and other nations in 1960 were delivered at prices as much as 55% below current American scales.

These figures came to light in the recent testimony of H. S. Potter, spokesman for the U.S. Tool and Fine Steel Industry, before the House Subcommittee on the Impact of Imports and Exports on American Employment. Said Mr. Potter: "Imports of tool steel and products made from tool steel cost us an estimated 2000 jobs last year."

The loss of business because of imports is a matter of grave concern to the 14 U.S. tool steel producing companies. "American producers cannot sell at the level of current import prices," he said, "without operating at a loss. In time of national peril or emergency, I can say only that we face the possibility of eliminating a national resource of inestimable value if we permit the tool steel industry specialists to disappear.

Fatigue Causes And Prevention

METALLIC FATIGUE, by W. J. Harris, published by Pergamon Press Inc., 122 East 55th St., New York 22, N.Y. Volume 1, 331 pages. Price $12.50.

This newcomer to the international series of monographs in aeronautics and astronautics, gives a broad survey of the major factors affecting the fatigue behavior of metals.

The author draws on his vast experience as chief physicist for the de Havilland Aircraft Co., Ltd., but he has not restricted his writing to any one science. His theoretical treatments of such factors as stress concentration, frequency effects, corrosion, fretting, crack propagation, and statistics show much original thinking. Possible solutions to fatigue problems were selected because of their feasibility with conventional well equipped engineering facilities. Fatigue consciousness, according to Mr. Harris, starts at the drawing board, runs the gamut of design and development to the production shop floor.

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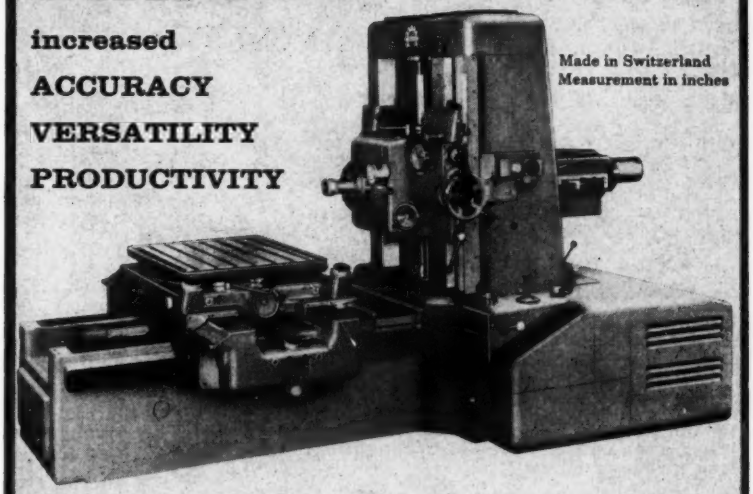

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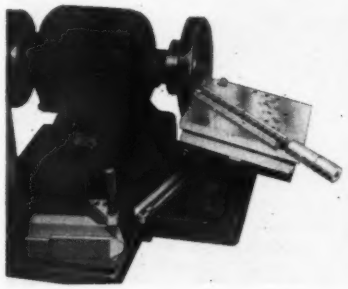

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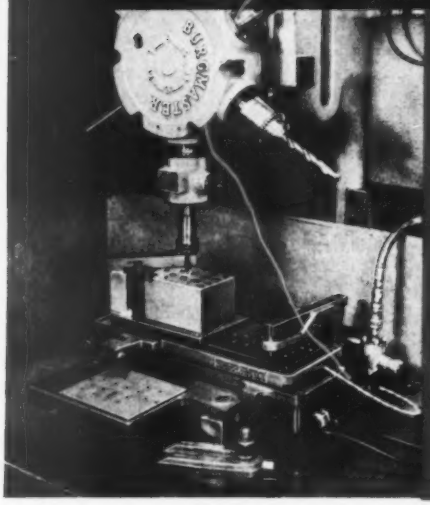

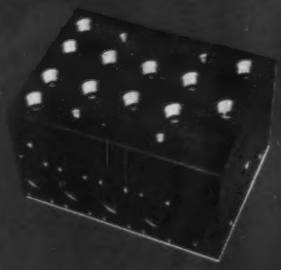

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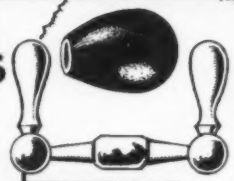

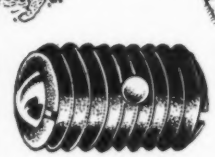

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In-plant plating of worn electric motor parts is saving a Cleveland concern precious waiting and machining time.

The firm is Reliance Electric and Engineering Co. They use the Dalic controlled area electroplating process to exactly re-size worn bearing journals when repairing electric motor armatures.

Use of this method not only eliminates the delays and expense involved in removing each shaft from its armature and rotor, but saves up to a week's time on a job, compared to sending the shaft out for conventional bath plating and then regrinding of the plated surfaces.

Plating time with Dalic averages 30 min/journal, with no shaft removal or grinding required.

Fully-assembled armatures and rotors from motors ranging in size from 5 to 500-hp are first removed in Reliance Electric's motor rebuilding department, that has the new plating equipment. They're then placed between centers of an engine lathe and rotated. A fine grain nickel deposit is built up on each bearing surface by a hand-held Dalic stylus saturated with the plating solution. Simple polyethylene film masking, taped in place, keeps the plating solution out of armature windings.

Current flow during plating is from the Dalic stylus (anode) through the solution to the shaft (cathode). Current density, and consequently plating time required, is regulated with a simple dial adjustment on the Dalic rectifier unit.

For more information on the Dalic process, write to Sifco Metachemical, Inc., 935 E. 63rd St., Cleveland 3, Ohio, or circle Inform-A-Gram No. E5.

for vital cost reductions in assembly and machining

specify-**Standard Cam-Operated Indexing Units**

Standard, Index Units . . . Rotary and Straight-line . . . are designed to be used in machines to provide automatic index motion to fixtured dials and direct mechanical motion to insertion stations, escapements and probes.

Fast, smooth, shock-free indexing is assured by the use of cycloidal cams—with extreme accuracy and at production rates to 6000 per hour.

Standard Model ST-A9AB Precision Rotary Index Unit. For light to medium duty. 4 to 20 stations. Accuracy to ±.0005″ at 6″ radius. Production rate to 6000 per hour.

Standard Model St.-A9B. Heavy duty Rotary. 8 to 24 stations. Accuracy to ±.001″ at 7″ radius. Production rates to 6000 per hour.

Standard Model St-A18 . . . Heavy duty transfer type, straight line unit 27 to 51 work carriers accuracy to ±.003″ production rates 6000 per hour.

Write for complete engineering bulletin, 26-T on Standard Cam-Operated Indexing Units.

MACHINERY DIVISION

Standard Tool & Manufacturing Co.

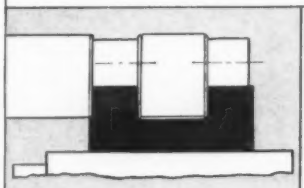
738 SCHUYLER AVENUE • LYNDHURST, NEW JERSEY

Better Products at Lower Cost Through Better Methods

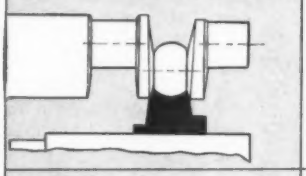
CIRCLE INFORM-A-GRAM KEY NO. 83

Eccentric Forming on Greenlee Automatic Bar Machines

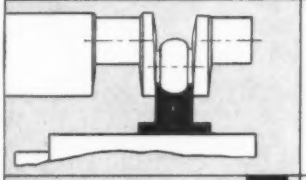
MACHINE . . . 1-5/8" — 6 Automatic Bar Machine
TOOLING . . . High Speed Steel
MATERIAL . . . B1112
STOCK SIZE . . . 1" round
TOOL SLIDE STROKE . . . 1-3/16" at .0042" feed
SPINDLE SPEED . . . 420 rpm 110 sfm
MACHINE TIME . . . 43 seconds
ESTIMATED GROSS PRODUCTION . . . 83 per hour



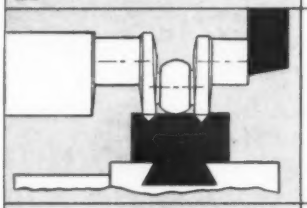
1. Rough eccentric form .550" diameter and 1/32" radius.



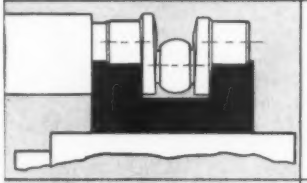
2. Rough eccentric form .643" spherical diameter, finish form inside tapered sides, and 1/32" radius.



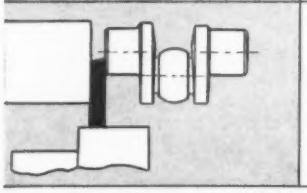
3. Finish eccentric form .643" spherical diameter and .023" radii.



4. Face end. Break corners on 1" diameters.



5. Finish eccentric form .550" diameter, outside tapered sides, 1/64" radii, chamfer 45° on ends, and break-down for cutoff.



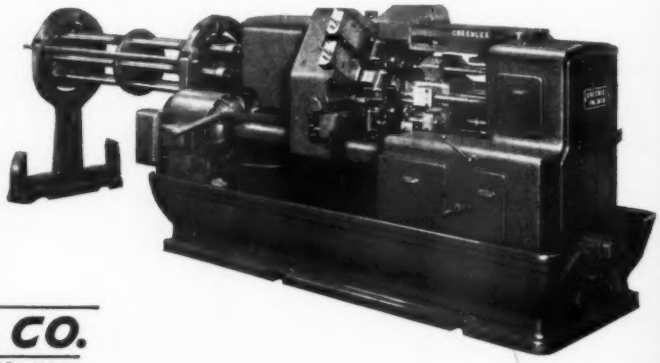
6. Cut off.

PRODUCED WITHOUT COSTLY "SECOND OPERATION"

"Union Special" relies on GREENLEE versatility to cut production costs of multiple eccentric crankshaft

Standard Greenlee Automatic Bar Machines are extremely versatile. Union Special Machine Company, manufacturers of industrial sewing machines, utilizes this production versatility to machine the multiple eccentric crankshaft illustrated. The part is machined from 1" round B1112 stock and is held in standard concentric collets. Part is machined in 43 seconds giving a gross production output of 83 pieces an hour. Sequence of operations is shown at left.

Special eccentric forming attachments mounted in the first, second, third, and fifth forming slide positions, rough and finish form the two eccentric diameters. Greenlee Bar Automatics permit greater job versatility and assure added profits. See your Greenlee representative or send us a print of your problem-part.



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13	27	63	89	123	761	1052	1114	1173	1261	1312	1362	
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C7	C17	C27	C37	C47	C57	E7	P7	P17	P27	P37	P47	
C8	C18	C28	C38	C48	C58	E8	P8	P18	P28	P38	P48	
C9	C19	C29	C39	C49	C59	E9	P9	P19	P29	P39	P49	
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7 21 35 83 98 732 784 1092 1152 1194 1292 1342 1384
9 23 36 84 99 741 821 1093 1153 1201 1293 1343
10 24 37 85 104 742 822 1111 1161 1202 1301 1344
11 25 38 86 121 743 823 1112 1171 1251 1302 1345
12 26 40 87 122 744 1051 1113 1172 1252 1311 1361
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14 28 65 90 124 762 1053 1121 1174 1262 1313 1363
15 29 68 91 135 763 1054 1131 1181 1271 1314 1364

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C3 C13 C23 C33 C43 C53 E3 P3 P13 P23 P33 P43 P53
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C9 C19 C29 C39 C49 C59 E9 P9 P19 P29 P39 P49
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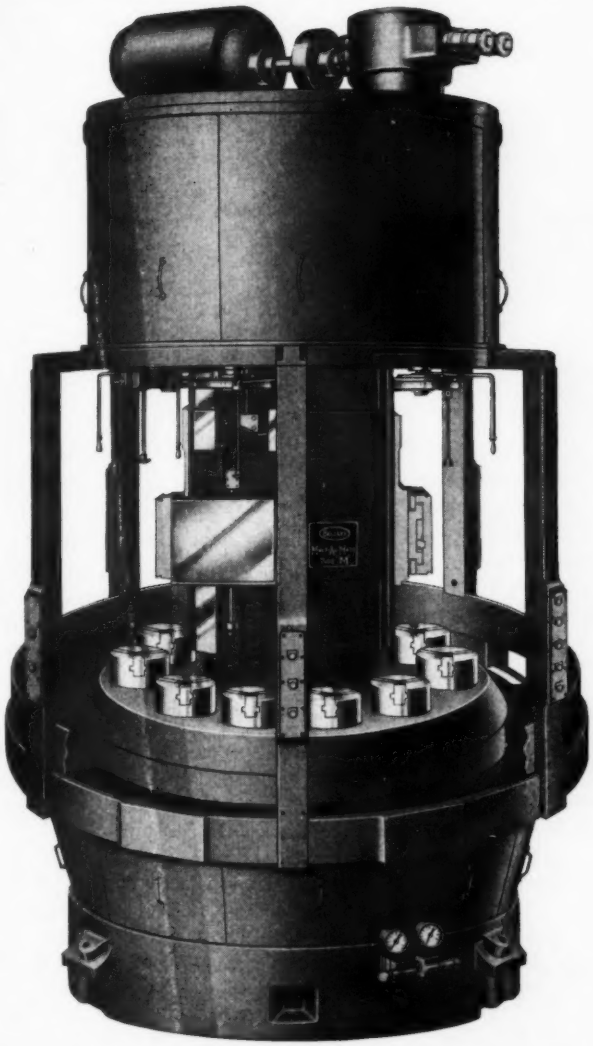

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The Bullard Company, Bridgeport 9, Conn.

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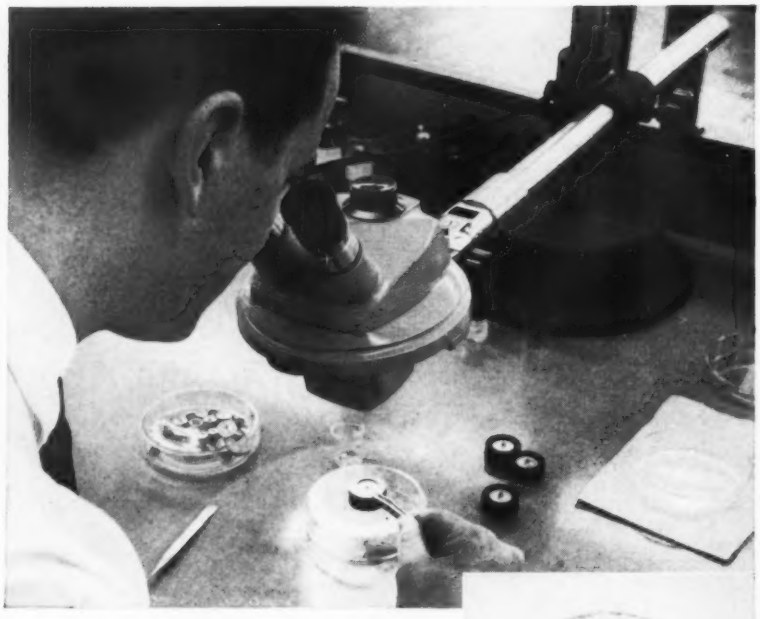
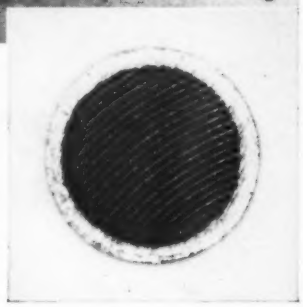
CIRCLE INFORM-A-GRAM KEY NO. 85





Polarad inspectors see .001" vanes magnified like this

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These are micro-grid vanes for the higher frequency microwave electron tubes made by Polarad Electronics Corporation, Long Island City, N. Y. Bausch & Lomb StereoZoom Microscopes play a critical part in their inspection. Because *only* B&L StereoZoom Microscopes provide infinite choice of magnification, *anywhere* within the entire range of the instrument. Just a turn of the Zoom knob shows their .001" vanes at the ideal magnification for checking continuity, spacing, surface finish, or contamination by foreign materials.

Work shows up vividly, in natural 3D detail. And there's unobstructed working distance (up to 7") to simplify Polarad's precision assembly of tube parts. That's why Maurice J. Cunniffe, manager of Polarad's Microwave Tube Laboratory, says: "The StereoZoom Microscope is an essential component of our laboratory facility."
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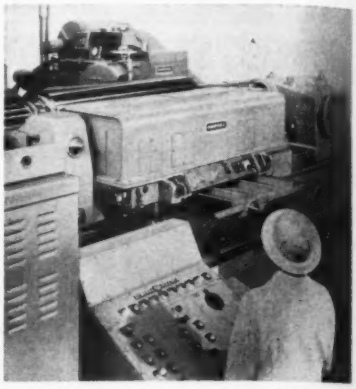
CIRCLE INFORM-A-GRAM KEY NO. 86

Keen Sense of Touch On NC Grinder

A new 60" heavy duty roll grinder, reportedly the first grinder to use numerical control, can detect a thousandth-inch difference in a five-foot thickness. A man with the same sensitivity of touch would be able to detect the thickness of an extra layer of paper on his cigarette.



The machine uses its uncanny sense of touch to finish work rolls for metal rolling mills. With probing steel fingers and General Electric numerical control, it measures the dimensions of rolls and calculates when they are finished. The electronic control also memorizes these dimensions, recalls them later as it directs grinding of a second matching roll and back-up rolls. It automatically grinds straight or crowned rolls up to 5 ft dia to exacting tolerances.

This extreme accuracy helps maintain definite standards for regrinding and avoids waste. The numerically - addressed sequence and servo control concept is similar to punched-tape numerical control. Operating from standard 1" punched tape, the control directs the grinder through a complete cycle and performs all operations necessary to refinish a roll. The grinding wheel is activated with the cycle start button and the machine and control system carry out rough grinding, aligning of workpiece, semi-finishing, wheel-dressing, finish-grinding, and finally measuring, and typing a printed record, of roll size.

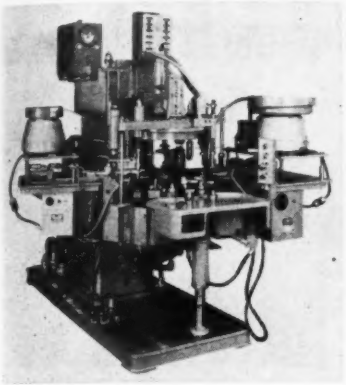
Seventeen specific operation sequences may be tape-programmed as primary functions, four others

as secondaries.

The first of three of these automated grinders will soon operate at the new hot mill of Great Lakes Steel Corp. They are manufactured by Farrel-Brimingham Co., Ansonia, Conn.

Machine Assembles, Sizes, Inspects

An alternate station dial triggers two operational sequences simultaneously on a Bodine 42-30 assembly chassis tooled for automotive valve production.



On the first pass, with the part in a vertical position, a bronze bushing is hopper fed into the valve and inserted by the machine slide. A sizing ball is pushed through the bushing. ID is sized with a Pratt-Whitney air gage. Failure to come within part tolerance stops the machine. Sizing ball return is extremely simple: a ball is pushed through the bushing into a funnel mounted tube where a venturi tube blows the ball back to insertion station.

Next the part is removed from the nest and placed over the mandrel fixture, while another goes into the nest. A check valve is assembled on this pass. A steel ball is hopper fed in the valve body. At the next station a coil spring is wound on a Torrington springwinder and blown into place. Springs are fed only on demand, since the springwinder is cycled to the machine. The part is then inspected for the presence of the check ball and spring. Finally a roll pin is hopper fed and inserted and the completed part is removed from the dial.

ONE...
just set the part on the anvil (no masters or set gages needed)

TWO...
turn the knob to lower spindle (stops automatically on contact)

THREE...
read the measurement directly from the scale (and save up to 85% in gaging time!)

MEASURE TO .0001"!

. . . that's how quick and easy it is with the Bausch & Lomb DR-25B Optical Gage!

Takes just seconds to get direct readings to .0001" . . . depth, thickness, height, diameter, taper. You read in "tenths" from 0" to 3" on a bright, magnified scale . . . with such extreme accuracy (0.000025") that you use this DR-25B instead of gage blocks. Specially calibrated to normal shop temperatures with easy conversion charts for any temperature fluctuation. Here's today's fastest, easiest way to get highest accuracy readings . . . with job-proved savings of as much as 85% in gaging time . . . for only $875!
See it, compare it, in a free on-the-job demonstration.

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CIRCLE INFORM-A-GRAM KEY NO. 87

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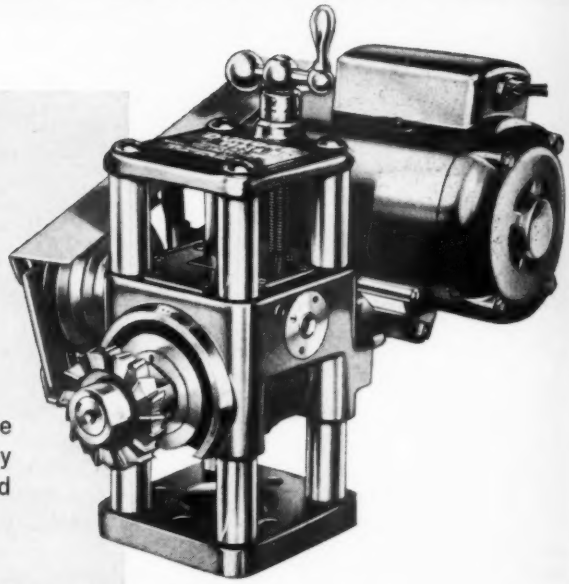
Compact, rigid, easy-to-move units in three sizes for all tooling needs. Perform in any position. Built-in power and feed. Priced from $595, FOB Racine.



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- **save handling, moving set-up and down-time**
- **one unit often pays for itself on one job**
- **provide close tolerance quality at profitable metal removal rates up to 1-1/2 cubic inches per minute in mild steel**
- **give you the advantage of machining where it is most economical—by letting you *take the machine to the work***

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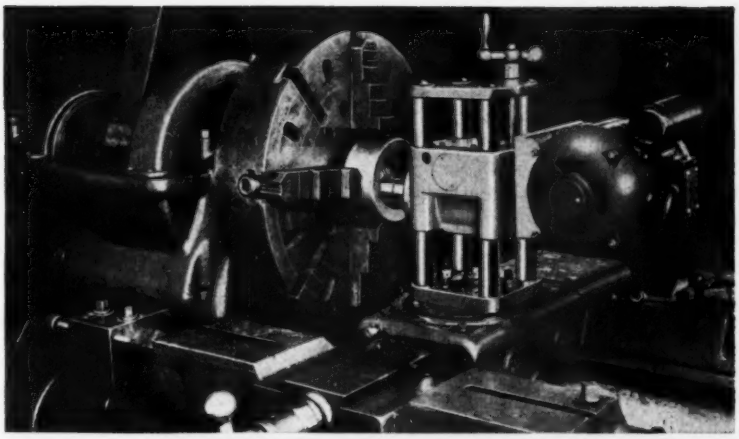
Use it as a

...machine tool attachment

Dumore Versa-Mil combines with any standard machine tool for secondary machining operations.



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GRINDS, DRILLS

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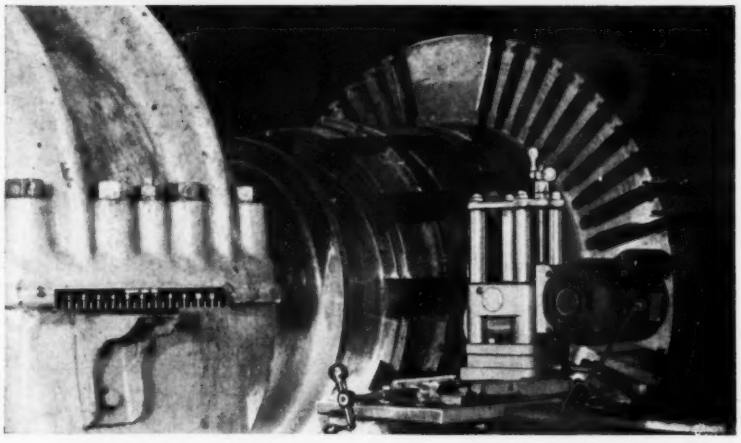
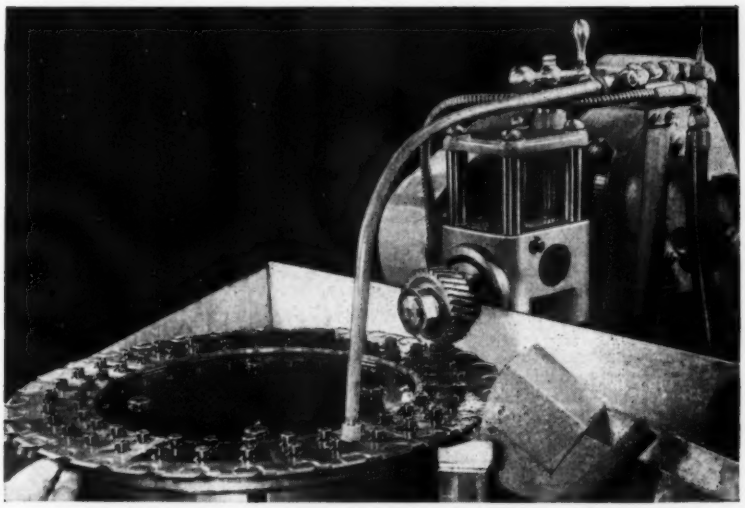


...portable machining unit

Built-in power and feeds, plus any position mounting, permit Dumore Versa-Mil to in-place machine parts or machinery too big to move or handle in standard machines.



...component for special machines

Dumore Versa-Mil adapts readily to special machining set-ups for production applications. Completely engineered accessories and attachments provide versatility for a variety of operations.

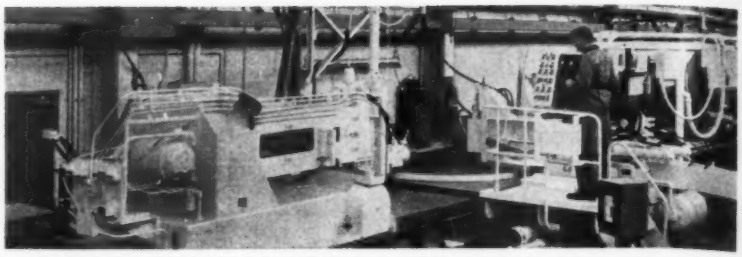
SEE HIM FOR A DEMONSTRATION...OR WRITE FOR BULLETIN VM-60-C

CIRCLE INFORM-A-GRAM KEY NO. 89

Texas Size Radial Former

Convair Corporation, Fort Worth, Texas, knows that a modern plant is not a condition, but a movement. That's why the company has an extensive machine replacement program. They have just ordered the largest major Radial Draw Former in existence.

The 300-ton colossus built by Cyril Bath Co., Solon, Ohio, will cost more than a million dollars. It has twice the capacity of its predecessors. This sixth of its kind to be installed in a General Dynamics' plant, will produce frame and skin elements for giant air vehicles. It will form some of the toughest new metallic alloys into very accurate shapes. Shapes that were previously impossible to produce! End products maintain accurate contours in subsequent welding and high temperature environments.



This is the Radial Draw Former at Republic Aviation. The one ordered for Convair is six times larger. Basic features are the same.

A smaller Radial Draw Former operates at Republic Aviation, Farmingdale, N.Y. Another is on its way to Rohr Corp., San Diego, Calif. This newest, and largest unit will have an ultimate successor ten times its size. That one is still on the drawing board according to Cyril Bath engineers.

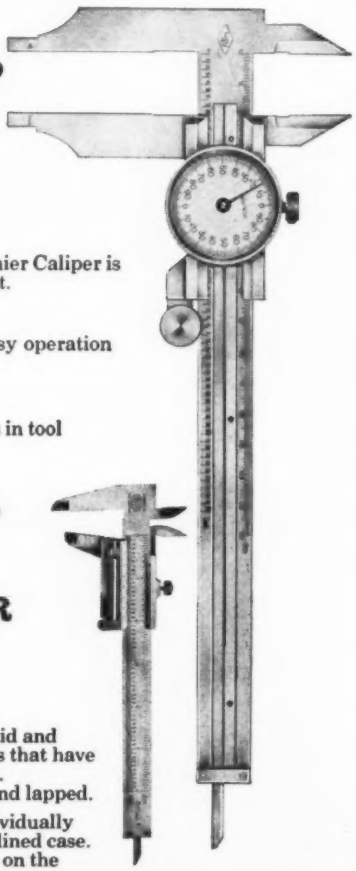
Compiler Cuts Costs

The industry's first multi-programmed scientific algebraic compiler, for use on the Honeywell 800 electronic computer, cuts manual programming of scientific and engineering problems by 90%. This automatic coding system accepts ordinary mathematical instructions and expands them into detailed computer language at one-tenth the cost and effort of earlier systems.

Compiler language is more concise than machine idiom. The computer itself translates compiler directive into machine instructions. Object program is documented with explanatory remarks and an error-detection system is provided. An entire program is compiled at once and batch compiling is possible. An expression may be designated as Boolean by placing a B in Column 1 on the statement card. For special applications hand-coded sub-statements may be written. Interspersed ARGUS coding may address ARGUS and/or algebraic compiler variables.

Eliminate costly reading errors with the

"HELIOS"
DIAL VERNIER CALIPER with built-in DIAL INDICATOR
Direct Reading in .001"



The world famous "HELIOS" Dial Vernier Caliper is hardened, ground and lapped throughout.

Other features:

- Thumb roll permits quick and easy operation
- Knurled lock screw
- 100% measuring capacity (outside, inside and depth.)

Available in 5", 6", 8" and 10" capacities in tool steel or stainless steel.

Height Gage Attachment optional.

"HELIOS"
SWING-JAW VERNIER CALIPER
with knurled lock screw

- Direct Reading
- Capacity 4¾"
- Length of Jaw 1⅝"

The swinging jaw allows a very easy, rapid and extremely accurate measurement of parts that have faces which do not lie along the same axis. This caliper is stainless steel, hardened and lapped.

Every "HELIOS" Vernier Caliper is individually packaged in a beautiful hardwood velvet-lined case. Write for detailed information and prices on the "HELIOS" Caliper line.

M. B. I. EXPORT & IMPORT LTD.
MBI
475 Grand Concourse, Bronx 51, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 90

Calendar of Events

October 4-6 American Society of Mechanical Engineers' Process Industries Conference, Shamrock Hilton Hotel, Houston, Texas.

October 4-6 American Machine Tool Distributors Association's annual meeting, Penn-Sheraton Hotel, Pittsburgh, Pa.

October 10-12 American Standards Association's 12th National Conference on Standards, Houston, Texas.

October 17-19 American Society of Mechanical Engineers/American Society of Lubrication Engineers' Lubrication Conference, Morrison Hotel, Chicago, Ill.

October 18-20 33rd Annual Meeting Gray Iron Founders' Society, Royal York Hotel, Toronto, Ontario, Canada.

October 19-20 1961 National Conference on Industrial Hydraulics, Sherman Hotel, Chicago, Ill.

October 19-20 Midwest Conference of the American Society for Quality Control, Chase-Park Plaza Hotel, St. Louis, Mo.

October 23-27 American Society of Metals, 1961 Detroit Metals Show, Cobo Hall, Detroit, Mich.

October 23-25 Fall Meeting Abrasive Grain Association, Astoria Hotel, New York, N.Y.

October 25-27 The National Management Association's 1961 Annual Convention, Sherman Hotel, Chicago, Ill.

October 29-November 1 National Metal Trades Association Convention, Hotel Commodore, New York, New York.

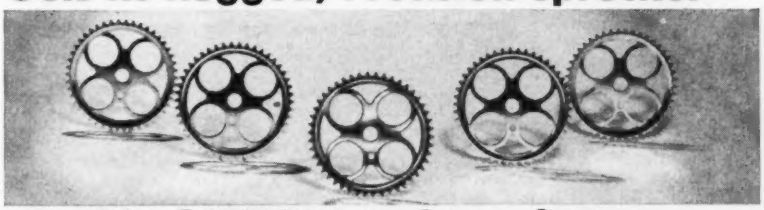
New Screw Machine Standard

The American Standards Assn. recently approved a revised standard, of interest to TOOLING & PRODUCTION readers. The literature is developed and published by the American Society for Testing Materials. It's title: "American Standard Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines (ASTM B16-60,) H8.1-1961."

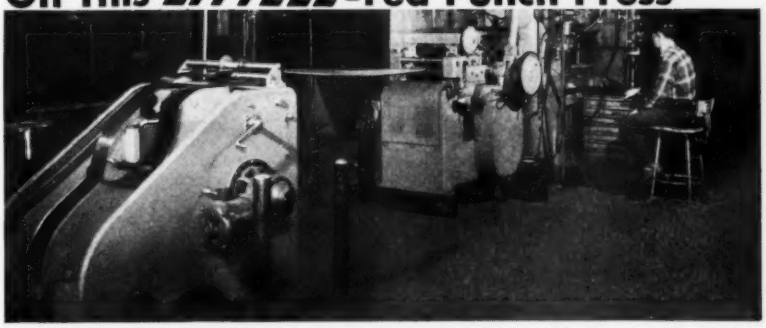
Copies at 50 cents each, from American Standards Assn., Dept. P249, 10 East 40th St., New York 16, New York.

The Schwinn Bicycle

Gets Its Rugged, Precision Sprocket

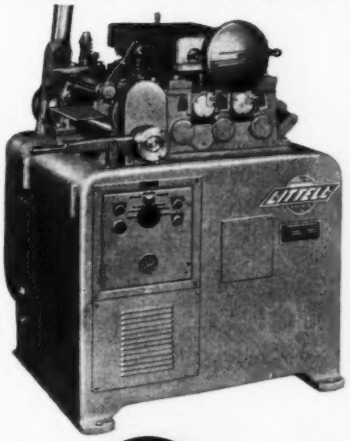


On This *LITTELL*-Fed Punch Press



Stamping out sprockets for famous Schwinn Bicyles is *precision* stamping. The special high strength steel stock is perfectly conditioned for accurate work. Flat stock, free of coil curvature, reaches the die area at perfectly timed intervals. For sprockets and other vital parts, Schwinn achieves this straightening-feeding precision economically, using the Littell "HRP" self-powered, hydraulically driven feeding and straightening machine. The "HRP" will serve you as well.

"HRP" is Versatile, Accurate, Convenient



The straightening-feeding cycle of the self-powered HRP unit is synchronized with the stamping cycle of the press by a single electrical connection. HRP units remove the coil curvature, and feed the straightened stock to the press or shear at precisely the desired speed. They feed from either side of the press, or from front to back. They can be positioned at special angles to produce specially shaped parts. Pulling an electrical plug disconnects the "HRP" from the press. Furthermore, the "HRP" can be easily moved from press to press by a lift truck. Facts in Bulletin B-10.

3 STANDARD "HRP" SIZES

STOCK CAPACITIES

12" wide x .090" thick
18" wide x .062" thick
24" wide x .050" thick

F. J. LITTELL MACHINE CO.

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"Get Bulletin B-10.
All facts. No charge."
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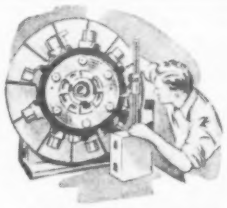
T&P Catalogs & Literature

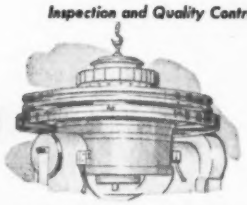
Reprints of "Heat Treatable Steel-Bonded Carbides" are available from Sintercast Division of Chromalloy Corp. The paper was presented at the 16th annual meeting of the Metal Powder Industries Federation. Inform-A-Gram No. C1.

Aeroquip Corp.'s Bulletin 629 explains the uses of self-sealing couplings. The handy 20-pager is well-illustrated and prepared to acquaint the engineer or technician with general information, rather than specific details. Inform-A-Gram No. C2.

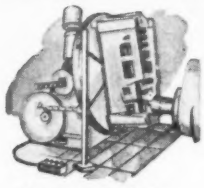
Faceplates from 12" to 84" in diameter
5 second accuracy standard . . . 2 seconds available



Inspection and Quality Control



Experimental and Tool Room Layout



Tool Room Machining

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Applications for *ROTAB* precision tables are, in fact, limited only by user imagination. For *ROTAB* units are being successfully utilized for receiving, tool and gaging, stage and final inspections, and for analytical spot checks on parts in process. *ROTABs* are proving highly effective in quality control for statistical data procedure, quality, casting and pattern analyses. They're saving time, increasing accuracies in experimental and tool room layout, too. And they've even performed outstandingly as cost-cutting machining fixtures for high accuracy positioning of difficult and complex tool room operations.

How does *ROTAB* come by this versatility? By offering single set-up, 3-dimensional positioning with optically precise 5-second accuracy (and with readings to 1 second repeatability!), motor-driven, pendant controlled movement, horizontal loading and many more advanced engineering features. *You* can use *ROTAB*, and we can show you how.

Write today for your FREE ROTAB CATALOG!

MP MACHINE PRODUCTS CORPORATION
6771 E. McNICHOLS ROAD • DETROIT 12, MICHIGAN
CIRCLE INFORM-A-GRAM KEY NO. 92

Portage Double-Quick, Inc. offers literature on a new drill press attachment for drilling, counterboring, chamfering, reaming, controlled entering, and removing nibs. Check No. C3.

"Compression Tube Fittings" catalog from Parker-Hannifin Corp. presents 25 items of the Ridg-lok tube fitting line with illustrations and dimensions. Circle Inform-A-Gram No. C4.

"Guide to Hydro-Pneumatic Accumulators" is offered by Greer Hydraulics, Inc. on Inform-A-Gram No. C5. The illustrated reference manual covers operating principles, designs and uses of hydraulic accumulators.

R. K. LeBlond Machine Tool Co.'s new 4025 NK heavy-duty lathe is the subject of a just-issued bulletin. Interested? Circle Inform-A-Gram No. C6 for Bulletin HD-461.

Bulletin 813-A describes American Tool Works Co.'s traveling openside boring and drilling machine. The unit has a 19" column and a 104" wide work area. Its numerically controlled by a GE Mark II system. Inform-A-Gram No. C7.

Data sheet CS/TS-4-11-1 from Vernitron Corp. is an aid for rapid and correct selection of size 11-400 cycle Thru-bore control and torque synchros for servo applications. Inform-A-Gram No. C8.

Bulletin GM62 presents four new Micromaster surface grinding machines from the Machine Tool Div., Brown & Sharpe Mfg. Co. Check Inform-A-Gram No. C9.

Lehigh, Inc. offers new literature on several of the company's new products. Included are heavy-duty, double-acting air motors; Checktrol, a self-contained hydraulic unit; new air cylinders and packaged drill feeds. Inform-A-Gram No. C10.

"Walton" tap extractors that fit taps for helical coil wire screw thread inserts are featured and priced in a flyer from The Walton Co. Inform-A-Gram No. C11.

Model 12B electrolytic cutter and tool grinder is outlined in a bulletin from Covel Mfg. Co. Inform-A-Gram No. C12.

Catalogs . . .

Innershield welding is described in Bulletin 5300.1 from Lincoln Electric Co. Performance characteristics and process speed are compared with manual shielded metal arc and semi and fully automatic submerged arc welding. Inform-A-Gram No. C13.

Surfindicator is a portable instrument that measures surface microfinish on metal, plastic, glass or other materials regardless of shape or composition. This unit is described in a folder from Brush Instruments, Div., Clevite Corp. Inform-A-Gram No. C14.

A fully illustrated 32-page catalog from Valenite Metals lists standard blanks, rectangular shapes, squares and diamonds, discs, center tips and many others. The brazed tool section contains more than 200 styles and sizes. Inform-A-Gram No. C15.

Air-operated diaphragm chucks for high-speed internal and external chucking are announced in a brochure from Erickson Tool Co. Check Inform-A-Gram No. C16.

National Acme Co.'s new single chaser Vers-O-Tool backs off automatically at the end of the cutting stroke. It's described in Bulletin SVT-1. Circle Inform-A-Gram No. C17.

Special sizes of high speed taps, dies, thread, plug and ring gages are listed on a handy 14 x 22" wall chart from Field Tool Supply Co. Inform-A-Gram No. C18.

Coromant tungsten carbide tooling is extolled in a 50-pager from Sandvik Steel, Inc. Circle Inform-A-Gram No. C19 for your free copy.

Standard and special taps are described in a handbook from Besly-Welles Corp. Included are a tap users' guide, trouble shooting, resharpening instructions and handy tables on thread constants, Acme threads, and drill diameters. Inform-A-Gram No. C20.

How to select cylinders by size, thrust, bore, stroke, mounting, etc., is outlined in a 32-pager from Miller Fluid Power Div., Flick-Reedy Corp. Request Bulletin AJH-104S on Inform-A-Gram No. C21.

Simple pencil line sketches of intricate shapes and forms can now be used to guide oxygen shape-cutting machines with an electronic tracer. It's explained in a free booklet from Linde Co., a division of Union Carbide Corp., Inform-A-Gram No. C22.

A new catalog outlines equipment and methods for performing from relief grinding on a variety of cutting tools. Yours free from R-O Mfg. Co. on Inform-A-Gram No. C23.

Where, when and how to use Ceramic VR-97 is described in Bulletin 61.1 from Vascoloy-Ramet Corp. Also included are finishing information, machinable materials, tool geometry, new applications and ceramic trouble-shooting. Inform-A-Gram No. C24.

Cam indexed Camtrol roll feeds for precision feeding of dynamically controlled roll and strip stock at 3000 ipm are described in Catalog 500. Ferguson Machine Co., Inform-A-Gram No. C25.

SYNTRON PARTS FEEDERS DO THE WORK OF MANY HANDS

Vertical Vibratory

SYNTRON PARTS FEEDERS

—speed production, increase efficiency of most operations requiring continuous controlled feeding of small parts.

—flexible enough to handle a wide variety of parts—sizes, shapes materials.

—adaptable to most automatic machines. Supply parts in an oriented, single-line at rheostat controlled rates.

—dependable, powered by the world famous Syntron Electromagnetic drive unit, 3600 vibrations per minute, rheostat control, no mechanical wearing parts to replace or maintain.

—custom built, each feeder is engineered to the specific part that is to be handled.

Investigate the possibilities of Syntron Parts Feeders in your parts handling operation.

Feeding special bolts

Feeding special brass parts

Feeding wing nuts

Write today for a Syntron Catalog and complete information about Syntron Parts Feeders.

61PF1

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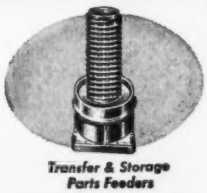
"Other Syntron equipment of proven dependable quality".

Lapping Machines



Transfer & Storage Parts Feeders

Bin Vibrators

CIRCLE INFORM-A-GRAM KEY NO. 93

Catalogs . . .

A 32-pager from Friden, Inc. explains the meaning of numerical control and the use of punched tape in machine tool applications. Inform-A-Gram No. C26.

Chip conveyors designed to be mounted as an integral part of high speed machine tools are described in Bulletin MF 650-A from May-Fran Mfg. Co. Inform-A-Gram No. C27.

A 28-page catalog shows the complete line of improved batch-type airless abrasive blast cleaning machines from Wheelabrator Corp. Free on Inform-A-Gram No. C28.

Dotco, Inc. offers Bulletin 103, which details Dotco air tools including right angle and vertical sanders, grinders for contour finishing of dies, mold finishing, forgings, castings, and for deburring machined parts. Inform-A-Gram No. C29.

"For Better Business Control" is a brochure that outlines applications and specifications of the medium-scale Honeywell 400 computer from Minneapolis-Honeywell Regulator Co., Electronic Data Processing Div. Inform-A-Gram No. C30.

Dynamaster #2 universal milling machines are covered in 20-page Bulletin MM55 from the Machine Tool Div., Brown & Sharpe Mfg. Co. The machines are offered with 3, 5, 7½ or dual 10/5-hp spindle drive motors and automatic climb milling arrangement. Inform-A-Gram No. C31.

Compressed air users will read Engineering Bulletin DAS with interest. It features a new approach to the old problems of compressed air use—too much moisture and too little capacity. Literature from the Air System Division of Lynch Corp. on Inform-A-Gram No. C32.

Ball bearing lathe centers and tailstock spindles from Nielsen, Inc. are shown in new catalog from that company. Circle Inform-A-Gram No. C33.

"Shutdown Master Planner" wall chart SM-5732 from Westinghouse Electric Corp. is offered on Inform-A-Gram No. C34. All items involved in a shutdown of maintenance activities are shown at a glance on this preplanner chart.

A new American standard is offered free by the Grinding Wheel Institute. The 36-pager entitled "AMS Specifications for Shapes and Sizes of Diamond Grinding Wheels, Hand Hones and Mounted Wheels" B74.3-1961, is available on Inform-A-Gram No. C35.

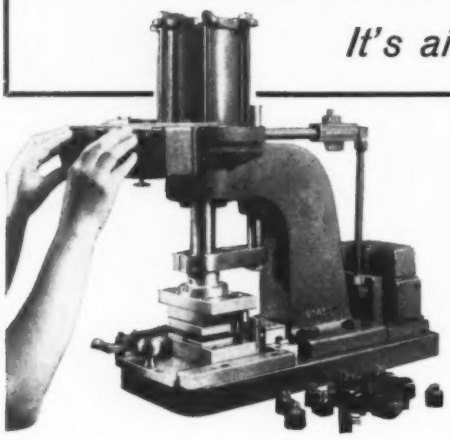
Mastercut, an oil base water soluble oil, is said to virtually eliminate heat caused by shock and stress in metal cutting. There are no sulphurs, chlorides, or phenols in Mastercut. S & S Engineering Co. offers brochures on Inform-A-Gram No. C36.

MSO a new multiple second operation machine from Standard Tool & Mfg. Co. is outlined in Bulletin 61. Mark Inform-A-Gram No. C37.

Three models of a double mitre saw are discussed in a catalog from LeTarte Co., Inc. Special features include 39" working height, and recessed knee control. No. C38.

Solve your "Small Parts" production problems with a **HANNIFIN "HAN-D-PRESS"**

It's air operated!



The husky Hannifin "Han-D-Press" takes operator fatigue out of light production operations where speed is the key to economy. A safe, easy-to-operate Hannifin air-operated bench press can handle these sometimes troublesome jobs better, faster and easier.

RIVETING
STAKING
PUNCHING
PRESSING
ASSEMBLING
MARKING

CHECK THESE FEATURES:

- Electric control through Hannifin 4-way solenoid-actuated valve.
- Guided ram. Speed easily adjustable. Automatic return.
- Removable steel base plate. Easy to change job set-ups using alternate work bases.
- Minimum maintenance. Rigid frame; cylinder "tru-bored" and honed.
- Half-ton and one-ton models. Low prices. Immediate delivery.

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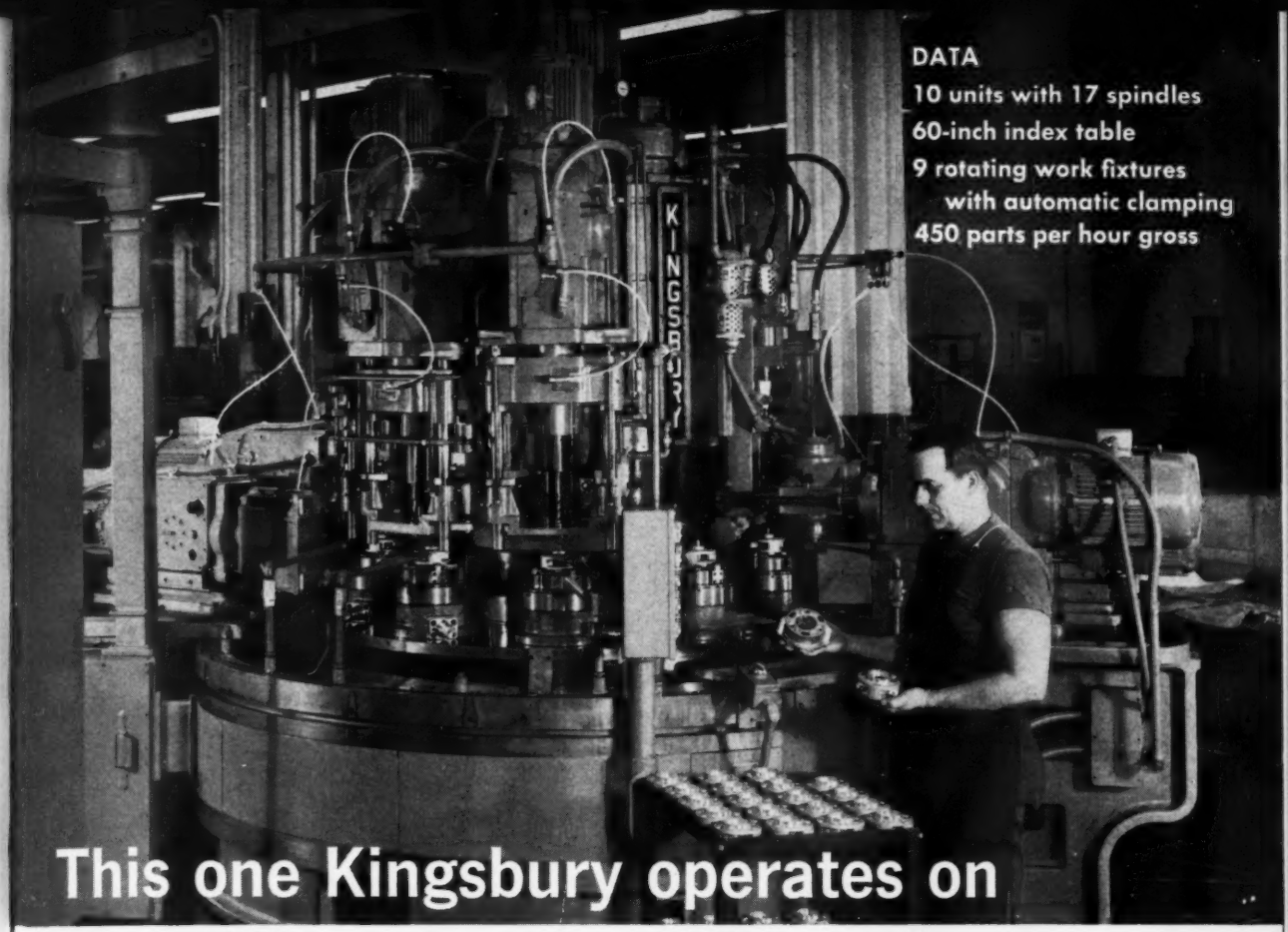
CIRCLE INFORM-A-GRAM KEY NO. 95



DATA
10 units with 17 spindles
60-inch index table
9 rotating work fixtures
with automatic clamping
450 parts per hour gross

This one Kingsbury operates on two different parts without changeover

Parts may be fed at random

This center column machine works on the two different parts shown with no changeover. The work fixtures hold either part without changing locators. Each fixture rotates 120° with each index of the table so the horizontal units can perform three sets of operations equally spaced.

Two of the vertical units drill two holes, one in each part. One unit drills Hole A in the bottom of the large part when its flange trips a micro switch. The other unit cycles every time, drilling Hole B in the top of the small part, "cutting air" in the large one.

You can make money with a Kingsbury. Here's how:

— One Kingsbury replaces several general purpose machines, saving space and labor.

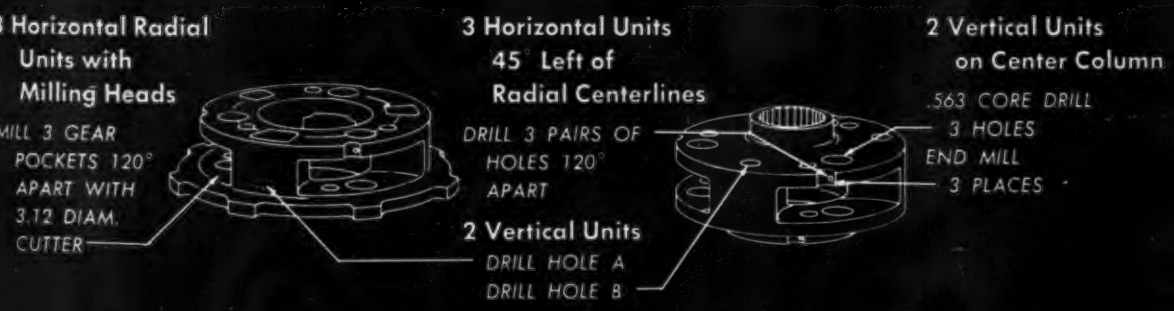
—You cut work-in-process inventory by eliminating several banks of parts.

—You cut maintenance costs. Because of good basic design and rugged, accurate construction Kingsbury machines have run year after year, through millions of cycles, without serious trouble.

—Your machine can go right into your production line because our test runs before shipment guarantee uniform parts that gage.

May we make a proposal? Kingsbury Machine Tool Corp., Keene, N. H.

KINGSBURY


3 Horizontal Radial Units with Milling Heads
MILL 3 GEAR POCKETS 120° APART WITH 3.12 DIAM. CUTTER
3 Horizontal Units 45° Left of Radial Centerlines
DRILL 3 PAIRS OF HOLES 120° APART
2 Vertical Units
DRILL HOLE A
DRILL HOLE B
2 Vertical Units on Center Column
.563 CORE DRILL 3 HOLES
END MILL 3 PLACES

ALUMINUM PLANET PINION CARRIERS FOR AUTOMATIC TRANSMISSION

Rectangular or square.
Grade A+ Croblox +.00004", −.000002"
Grade AA Croblox ±.000002"
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(rectangular only)

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Solid Chrome Carbide

are the lowest cost Gage Blocks

—based on the many extra years of service they give.

WEBBER Croblox, made of solid chrome carbide, one of the hardest metallic substances known, have a useful life expectancy up to 70 times that of standard steel blocks.

This fact alone makes Croblox a great money saver for manufacturers of precision products.

There is another saving — Webber Croblox, calibrated in split millionths, retain their accuracy over such a long period of time that production errors caused by worn blocks virtually are eliminated.

Another saving. Croblox, being 30 times more corrosion resistant than 18-8 stainless steel are not affected by moisture, finger prints, body or airborne acids, all of which can affect the accuracy and wringability of steel blocks.

Your inquiries are invited.

We also manufacture a full line of rectangular and square Steel Gage Blocks.

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Telephone CL. 1-1200

PIONEERS in the production of Chrome Carbide Gage Blocks — CROBLOX

Catalogs . . .

"Creative Framing" is the title of a 24-pager from Acme Steel Co. It unveils a variety of ideas and applications for creative framing of storage racks, shipping containers, tables, platforms and other structures of all sizes and shapes. Inform-A-Gram No. C39.

Bulletin MF-300 gives information on Flat-Top steel belt conveyors from May-Fran Mfg. Co. Flat-top conveyor belting permits flush-with-floor installation for more efficient plant layouts and smooth continuous traffic flow. Inform-A-Gram No. C40.

Dynamster 2 plain milling machines with 3, 5, 7½, or dual 10/5-hp spindle drive motors are outlined in Bulletin MM 56 from Machine Tool Div., Brown & Sharpe Mfg. Co. Circle Inform-A-Gram No. C41.

"Precision Granite Surface Plates and Straight Edges" gives reasons for selecting A. Ottavino Co.'s granite when accurate, nonmagnetic, suction-free, rustproof, warp resistant, temperature resistant and non-abrasive qualities are required. Inform-A-Gram No. C42.

Circling Inform-A-Gram No. C43 will bring you a booklet on Crys-Coat 187 from Oakite Products, Inc. The cleaner is cited for its chemical stability, positive corrosion control, long solution life and dual action of cleaning and phosphating.

A bulletin on the Uniflute countersink and the Unicam resharpening fixture from M. A. Ford Co., Inc. is offered on Inform-A-Gram No. C44.

The Alpha-Molykote Corp. offers #461 bulletin which describes test results of inorganic, solid-film lubricants performance in liquid oxygen. Inform-A-Gram No. C45.

Characteristics and application instructions of Molykote X-15 dry film lubricant are outlined in #242 from the same company. Circle Inform-A-Gram No. C46.

The Pure Oil Co.'s complete line of industrial lubricants is outlined in a new brochure from that company. More than 60 different kinds of industrial lubricants are listed. Inform-A-Gram No. C47.

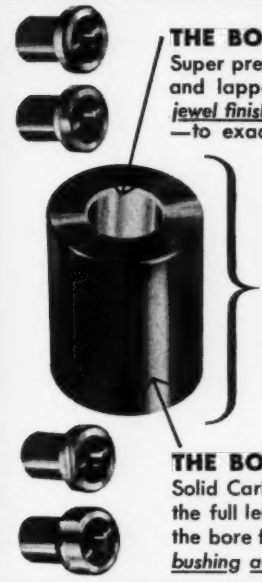
"More Than Meets the Eyelet" is a bulletin on engineered, high-volume, contract production of eyelets, drawn shells, and metal stampings for electronic, appliance instrument, and general metal-working manufacturing markets. From Cly-Del Mfg. Co. on Inform-A-Gram No. C48.

Taperlock plug gage blanks in high speed steel, not heat treated, are listed in literature from Huron Machine Products, Inc. Inform-A-Gram No. C49.

Catalog Sheet 4393A8 from Parker-Hannifin Corp. tells of Ferulok tube fittings. The tool, called Hy-fer-set, simplifies setting ferrules on steel, stainless steel, or monel tubing. Inform-A-Gram No. C50.

Assembly features, component parts, and practical advantages of three basic types of steel shelving are described in a 36-pager from Standard Pressed Steel Co. Check Inform-A-Gram No. C51.

deep holes... perfect holes... with S&E solid carbide Bushings*



THE BORE
Super precision ground and lapped to a *jewel finish*— concentric —to exact tolerance.

THE BUSHING
Rigid—Solid Carbide support for *tool-control* and *long tool life.*

THE BODY
Solid Carbide bearing the full length of the bore for *long run bushing accuracy.*

S&E Bushings Cost Less With long accurate bushing life (in excess of 50 times that of steel bushings), they *cut down-time* to the minimum and *boost production* to the maximum. The result is lower bushing costs, reduced inspection time, less scrap and lower tool inventory.

S&E Bushings Perform Best Extremely accurate work can be obtained with the use of these bushings, particularly where precise size and hole location are of paramount importance, or where rigid support and alignment must be maintained. *For gun drilling,* they are considered *a must* . . . they hold the bore size longer . . . they make the tool work better.

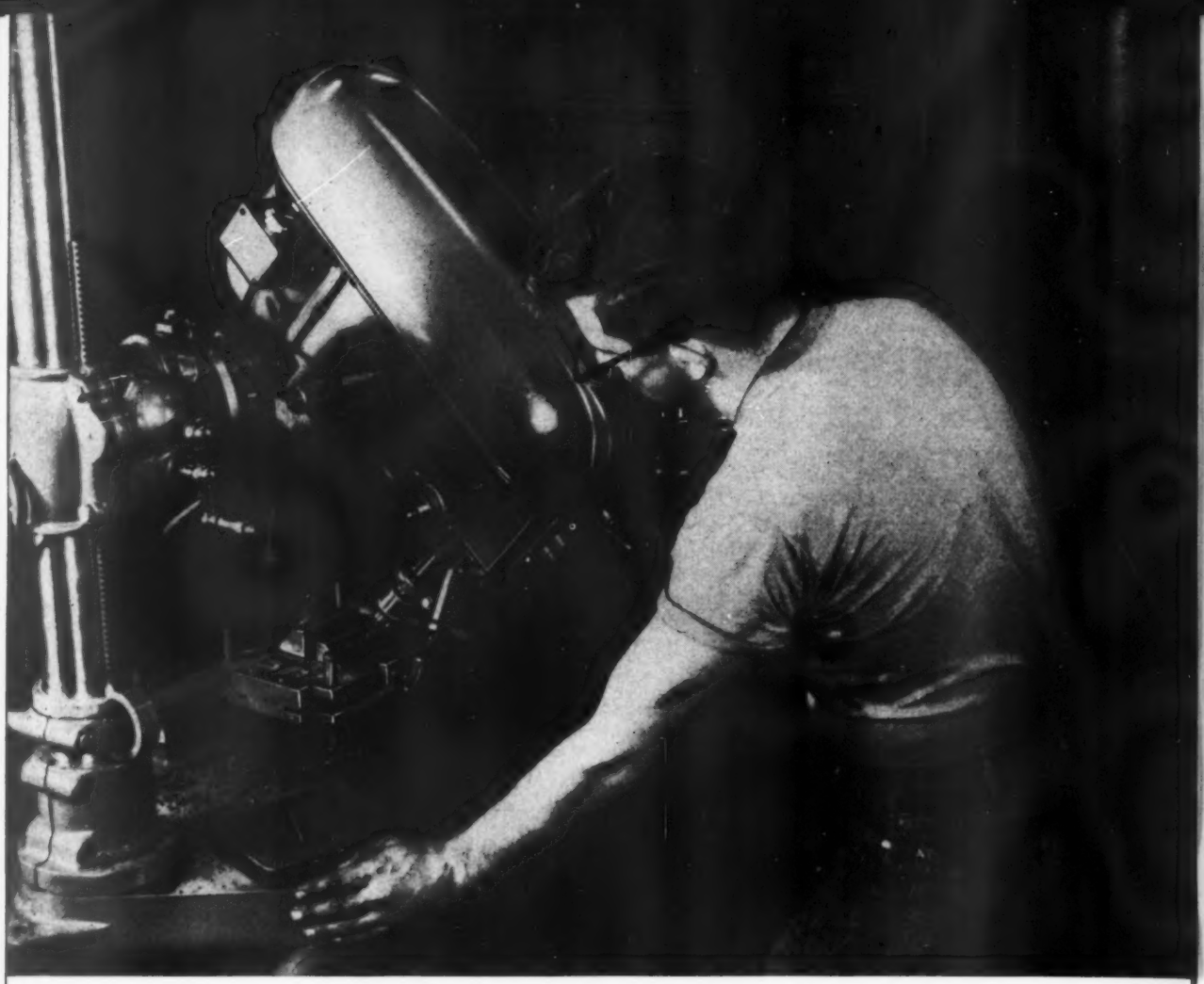
* Standard S&E bushings meet all A.S.A. standards. They are also available in all classes of (A.G.D.) gagemakers tolerances. Special and unusual type carbide bushings are regularly fabricated by S&E.

Complete catalog of S&E products available on request.

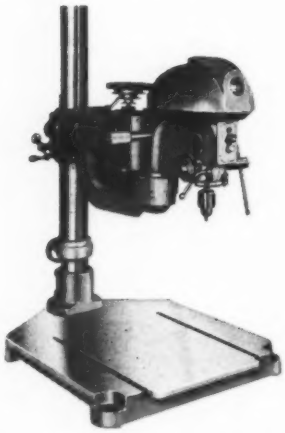
S&E MACHINE PRODUCTS INC.
Bridgeport, Michigan

Sales offices in all principal cities.

CIRCLE INFORM-A-GRAM KEY NO. 97



Position the tool—not the work with this new Delta Unidrill*



New Delta Unidrill line is available in bench and floor models or as components for custom assembly. Choose Utility or Deluxe Head, High or Slo Speed, Key Chuck or Tapered Spindle.

FREE BROCHURE catalogs full Radial Drill Press line. Write: Rockwell Manufacturing Company, Delta Power Tool Division, 622K N. Lexington Ave., Pittsburgh 8, Pa.

It's the unique double-swivel design that gives this new 2-foot arm radial drill press such big job capacity—in metal or wood. You can do more jobs faster and easier because you can move and tilt the drill head—position the cutting tool to the work in five different ways! This saves the cost of expensive jigs and cuts time-consuming shifting of the work.

You can drill to the center of a 48" circle—on or off the table. And with six interchangeable spindles or spindle adapters, you can change in seconds to handle reaming or spot facing of metal, routing or planing of wood, and many other jobs.

The only way to see how the Unidrill can solve *your* drilling problem is to see this flexibility in *action*. Your Delta Industrial Distributor (under TOOLS or MACHINES in the Yellow Pages) will gladly demonstrate. Call him.

*Trademark

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

CIRCLE INFORM-A-GRAM KEY NO. 98

Catalogs . . .

Model 21 single end precision boring machine from Olofsson Corp. is extolled in a bulletin from the company. Circle Inform-A-Gram No. C52.

"How to Win the Race for Storage Space" is the title of Booklet AD-409 from Acme Steel Co. It describes use of prefabricated storage rack materials for larger warehousing and greater operating efficiencies. No. C53.

Catalog 61, a 24-pager from Buck Tool Co., shows conventional independent chucks, Ajust-Tru dust proof, and steel power chucks. Circle Inform-A-Gram No. C54.

Read all about standard, fully automatic, heavy duty, press type broaching machines in a new brochure from General Broach and Engineering Co. Circle Inform-A-Gram No. C55.

Expanding mandrels for internal chucking within 0.0005 are listed in a new catalog from Erickson Tool Co. Inform-A-Gram No. C56.

Detroit Tap & Tool Co.'s latest bulletin explains advantages of thread rolling. Listed are bump type thread rolls, straddle type thread rolls. Inform-A-Gram No. C57.

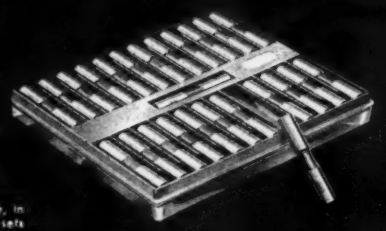
AMPCO tells the story of the company, its alloys, laboratories, facilities and distribution. From Ampco Metal Inc. on Inform-A-Gram No. C58. From the same company comes a bulletin on Ampcoloy specification bronzes. It's available on Inform-A-Gram No. C59.

Oliver Instrument Co. offers a bulletin on the new Model 600 fully automatic drill pointer. Also included is technical information on Oliver machines for wet and dry grinding. Circle Inform-A-Gram No. C60.

THE INFORM-A-GRAM CARD WHICH FOLLOWS PAGE 84 IS FOR YOUR CONVENIENCE IN MAKING INQUIRIES REGARDING ADVERTISED PRODUCTS AND EDITORIAL ARTICLES.

CIRCLE INFORM-A-GRAM KEY NO. 99

GAGING IN TENTHS? HERE'S CERTIFIED "X" ACCURACY, OFF-SHELF DELIVERY, 3,000 SIZES!



ALL SIZES .038 - .2050" IN STOCK IN TENTHS. 25-GAGE TENTH SETS NOW IN DRILL-SIZES #1-61, AND IN 64ths FROM 3/64" THRU 1"

$1.58 per gage, in 25-gage sets under .37.50"

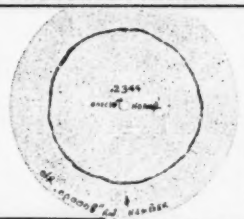
$39.40 25-gage sets under .37.50"

DELTRONIC

CLASS "X" - PLUS .000,040" - MINUS .000,000" • PRECISION LAPPED APPROXIMATELY 1 MICROINCH FINISH • LENGTH - 2¼", 2½", 3", 3½"

BLUE CHIP CUSTOMERS

AERO-JET GENERAL • CALIF. INSTITUTE OF TECHNOLOGY, JET PROPULSION LAB • CONVAIR DOUGLAS AIRCRAFT • NORDEN-KETAY • THOMPSON-RAMO-WOOLRIDGE • SUMMERS GYROSCOPE • RAYTHEON • GENERAL ELECTRIC • GRAFLEX • ACF INDUSTRIES • MARQUARDT AIRCRAFT • PERKIN-ELMER HAMILTON STANDARD • WESTINGHOUSE • CADILLAC MOTOR CAR CO. • FORD AERONUTRONICS • IBM • RCA • PHILCO



Certification of Accuracy

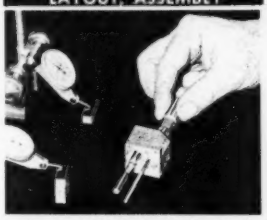
DELTRONIC CORPORATION unconditionally guarantees each gage herein to be within a size tolerance of plus .000,040", minus .000,000"; surface finish approximately one microinch; both ends concentric to one another. All Master Gages in our plant are calibrated semiannually or oftener, with standards traceable to the National Bureau of Standards, Washington, D. C.

Inspected by 235

RELIABILITY is assured through continuous checking and surveillance of all Deltronic production and inspection t ties by MetroLonics, an Independent Metrology Laboratory, with standards uninterruptedly and di traceable to the National Bureau of Standards, Washington, D. C. To maintain the most exacting requirements of precision mea ment, all gaging standards used in manufacturing of Deltronic gages are calibrated and certified quarterly . . . MetroLonics completely checks samples of each and every Deltronic production run.

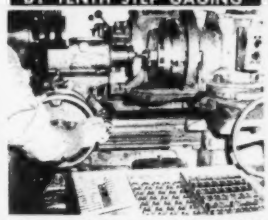
INSPECTION Electronic gaging equipment, accurate to ten millionths or better, is used for all measurement. Ri ness is checked on a Talyrond with spindle runout guaranteed to one millionth accuracy. A polar showing roundness of a production run Deltronic gage is reproduced at left. Final lapping, grinding, and inspection perform Deltonic's plant is in temperature controlled rooms, maintained within standard 68°, plus or minus one tenth of 1°

IDEAL FOR HOLE LOCATION, LAYOUT, ASSEMBLY



Manufacturer of Missile Components: "Used on measurement of precision servo devices which use highly precise gears, and whose center distances are extremely critical and must be maintained accurately. Also indispensable as assembly accessories for lining up gear boxes' bores. Tenth step gaging resulted in 30% saving on production-measurement and inspection of hole-spacing. Replaced standard plug gages and dial bore gages used formerly."

PRODUCTION SPEEDED BY TENTH STEP GAGING



Machine Tool Manufacturer: "With the .0001" steps, the operator knows at all times exactly what diameter the hole is and is able to correct his setting accurately. The short length of the Deltronic gage versus dial bore, or standard gage with handle, enables a much shorter backout. With the positive indication of size provided by the Tenth Step system, a savings of nearly one minute was effected on each part, and the gage set paid for itself on this one run."

INSPECTION SIMPLIFIE WITH VARIETY OF SIZES

Electronics Manufacturer: "Particularly desi was the low initial cost and the availability wide range of sizes in tenths for immediate thus making rapid production, drill jig inspection fixture checking easier. All of factors resulted in substantially saved time much greater product reliability than was p ble prior to using the Deltronic Gaging syster this precision gaging work."

PRICES OF SETS, AND NOMINAL SIZES IN STOCK

FRACTIONAL SETS

Complete coverage of every fractional size from 3.64ths thru 1", in 1/64th" increments.

PRICE LIST - FS64-A, B, C SETS

FS64-A - 3/64" thru 3/8"	$45.00
FS64-B - 25/64" thru 5/8"	$41.50
FS64-C - 41/64" thru 1"	$74.50

25-GAGE TENTH SETS

Nominal size, + and — 12 tenth steps. Set #TP25 consists of nominal gage with 24 additional gages. Twelve gages range upward from nominal in .0001" steps each. Twelve gages range downward from nominal in .0001" steps each.

PRICE LIST - TP25 SETS

Nom. sizes .039 thru .3750	$39.40
Nom. sizes .3775 thru .6270	$43.80
Nom. sizes 41/64" thru 1"	$52.20

"HALF-THOU-SETS"

Each set consists of a nominal size gage, plus 11 or 23 gages ranging upward, from nominal gage in .0005" steps . . . Nominal size coverage from .038" to .626" scheduled for production, in nominal size increments of .006", starting at .038"

PRICE LIST HT12, HT24 SETS

Nominal sizes	HT12	HT24
.038 thru 2.90	$23.90	$39.40

DRILL-SIZE SETS

Complete coverage of all number drill sizes, n nominally, for quick and accurate referen

PRICE LIST - DS61-A, B, C, SETS

DS61-A - 1 thru 20	$41.4
DS61-B - 21 thru 40	$41.4
DS61-C - 41 thru 61	$43.6

9-GAGE TENTH SETS

Nominal size, + and — 1, 2, 5, 10 tenths. S #TP9 consists of nominal gage with eight ad tional gages. Four gages range upward fro nominal .0001", .0002", .0005", .0010". Fo down from nominal, .0001", .0002", .0005", .0

PRICE LIST - TP9 SETS

Nom. sizes .039 thru .3750	$19.8
Nom. sizes .3775 thru .6270	$22.4
Nom. sizes 41/64" thru 1"	$29.8

THOUSANDTH STEP

Each set contains one nominal gage, plus gages ranging upward from nominal in .00 steps, and 12 gages ranging downward fro nominal in steps of .001", total of 25 gages each set.

PRICE LIST - THS-25 SETS

THS25-.050 thru .750	$39.4

PHONE YOUR LOCAL STOCKING DISTRIBUTOR FOR FAST SERVICE

ARIZONA Phoenix
Di Eugenio Tool — AL 8-8364

CALIFORNIA - Los Angeles
Eger Tool & Supply — CU 3-9213
Frey Industrial — LU 8-4281
Marshall Tool — AN 3-6121
Quality Control Co. — HO 9-5385
Don Richetts Co. — CU 3-5642
Paul B. Slater Co. — HA 3-7251
Union Industrial — UP 0-6936
Victor Tool — OR 8-4067

CALIFORNIA - San Diego
Quality Control Co. — Hollywood 9-5385

CALIFORNIA - San Francisco
Brennan-Hamilton — JU 9-2700

COLORADO - Denver
Di Eugenio Tool — EAst 2-5000

CONNECTICUT - W. Hartford
Thos. E. King Co. — AD 6-3522

FLORIDA - Miami
Lafayette Tool — NE 4-7604

ILLINOIS - Rock Island
Ziet Supply Co. — 6-5120

IOWA - Cedar Rapids
Ted Froeberg Co. — 2-6547

MARYLAND - Baltimore
W. C. Chapman and Sons — BR 6-5094

MASSACHUSETTS - Boston
Marton Equipment — WA 2-3848

MICHIGAN - Detroit
B-H Tool & Supply — JO 6-7943

MISSOURI - Kansas City
Haman Machinery — VI 2-3558

MISSOURI - St. Louis
Helco — PR 6-1787

NEW JERSEY - Caldwell
Stamco — CApitol 8-0660

NEW MEXICO - Albuquerque
Equipment Sales — CH 7-3781

NEW YORK - Manlius
House of Tools — HA 2-9432

NEW YORK - White Plains
Main Tool & Supply — 9-0037

NEW YORK - New York City
Mausner Equipment Co. — IV 1
A. N. Nelson, Inc. — Main 5
Morris Abrams, Inc. — CAnal 6

OHIO - Cleveland
U. S. Carbide Tool — LA 4

OKLAHOMA - Tulsa
Wm. L. Riggs Co. — TE 8

PENNSYLVANIA - Philadelphia
Alden Supply Co. — WA 2

TENNESSEE - Memphis
Branch-Marwin — BR 4

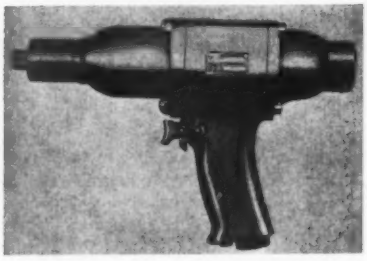
TEXAS - Dallas
Southwestern Precision — EM 3

WISCONSIN - Milwaukee
Abroline Machines — ME 4

DELTRONIC CORPORATION 929 BAKER ST., COSTA MESA, CALIFORNIA

T&P Product News

Air Impact Wrench



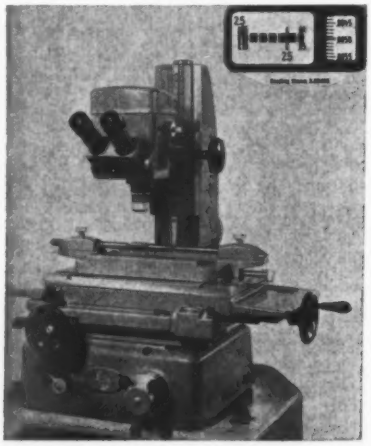
J-42T, a new torque-controlled air impact wrench, is designed for innumerable assembly jobs, particularly those where specified torque requirements must be met. A unique hydraulic mechanism shuts the tool off when required torque is reached. Its range is from 20 to 100 ft-lbs. An exclusive feature is the exceptionally fast rundown and impact speed while holding close torque. Optional drives are ½" sq. drive, ⅝" sq. drive or 7/16" hexagon external quick change chuck. Rotor Tool Co., 26300 Lakeland Blvd., Cleveland, Ohio offers added information, or circle No. P2.

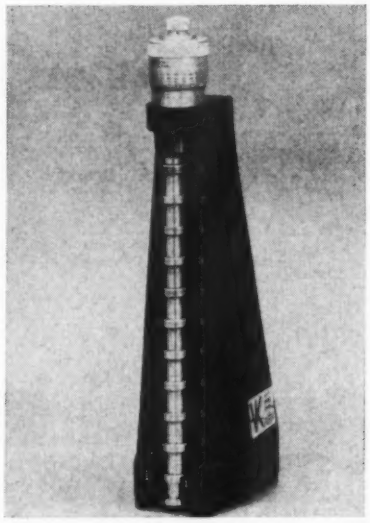
Wide Range Measuring

A new 12" height gage measures from 0.250 to 12". It's accurate to 0.000050 on any measurement. In a matter of seconds it's ready to inspect drill jigs, lathe fixtures, gears, cams, splines, contours and many other daily shop operations. A spring loaded non-rotating measuring column features a series of 0.250 to 0.750 spacers lapped to gage block accuracy. The 0.250 spacers are lapped flat and parallel, which allows readings from either top or bottom side of the spacers. The spring loaded construction eliminates backlash. The Van Keuren Co., Watertown, Mass. offers these accessories: 3 and 6" riser blocks and 18 and 24" transfer stands. Inform-A-Gram No. P1.

Better Readings

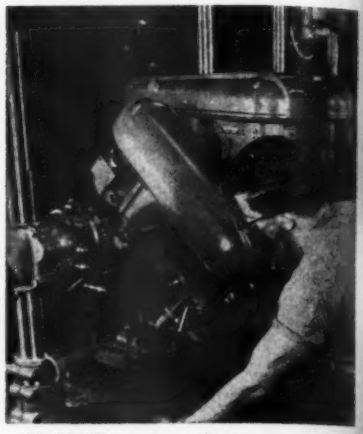
Newest of the Leitz toolmaker





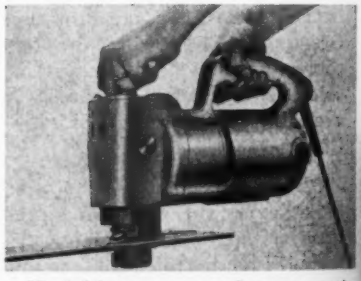
miscroscopes boasts an increased range of 3 x 8". It has a purely optical measuring stage and a binocular microscope tube. The 3 x 8" master scales are read directly in 0.0001 through a single projection window. Measuring in both directions is continuous and simple. Another innovation—the binocular intermediate image tube retains the 1:1 relay system of the standard Leitz tube, plus a second relay ratio of 5:1. Along with the convenient binocular observation, the new tube features 1:1 thread and radii charts, internal protractor and a double-image adapter. Address inquiries to Opto-Metric Tools, Inc., 137 Varick St., New York 13, N.Y., or check No. P3.

It Fills A Need



Unidrill, a two-foot-arm radial drill press, fills the gap between expensive machine-tool drill presses and light duty machines. It's designed for moving the tool instead of the work. This saves time and labor. Unidrill moves from one work area to another with ease. For work positioning, an operator can move the entire mechanism up and down the main column, or swivel the mechanism 360° and rotate the head around the mounting post. He can also move the head in and out from the column. For simplified angle drilling, he can tilt the head 45° left or right. The unit comes from Power Tool Div., Rockwell Mfg. Co., 492 N. Lexington Ave., Pittsburgh 8, Pa. No. P4.

Gobbler



Variable torque produces a variety of strokes for cutting different thicknesses with a new cutting tool. Greatest power of stroke is exerted for cutting stainless steel with a small stroke. The Model SN-40 will cut ¼" c.r.s., 7/32" stainless steel, and ⅜" aluminum. It has a carbide die, built-in lubricator, and circuit breaker. More from Modern Mfg. Co., Inc., 680 Davisville Rd., Willow Grove, Pa. or on Inform-A-Gram No. P5.

The story behind the chips

Savings In Time—Lower Tool Costs—Finer Finishes—More Accurate Cuts

Many types and sizes of *standard* Putnam End Mills are considered as "specials" by other manufacturers. Thus, Putnam customers get off-the-shelf deliveries that get their end mills on the job faster and at lower cost than "specials."

On the job, Putnam End Mills again save time and money. Designed for fast, free-cutting action, these end mills have extra long life. They will stand up when operated at high speeds and heavy feeds—on the toughest metals they really "hog-in" to quickly remove stock.

For applications requiring accurate cuts, Putnam's attention to manufacturing details and rigid quality control assures complete uniformity in each end mill. Also, users often find the exceptionally fine finishes obtainable with Putnam End Mills eliminate the need for grinding or hand finishing.

A pile of chips—the milling job is completed. But, for users of Putnam End Mills, there is always a story of unusual savings and benefits behind that pile of chips.

PUTNAM
TOOL COMPANY
2981 CHARLEVOIX AVE. • DETROIT 7, MICHIGAN

MILLING ALUMINUM – Putnam has a complete line of *standard* end mills that are specifically designed for efficient milling of aluminum and aluminum alloys.

Over 1800 Standard Types & Sizes of Putnam End Mills

Now you can order standard end mills ranging in diameter from 1/32″ to 6″ and get off-the-shelf delivery. In the Putnam line of over 1800 standard types and sizes are many end mills that are considered as "specials" by other manufacturers.

For example, in the MITEE-MITE series of standard end mills, diameters as small as 1/32″ are available. Thus, your milling, profiling, routing or engraving jobs in small or hard-to-get-at areas can now be done without special tooling.

Regardless of your requirements, there probably is a Putnam standard end mill that will exactly meet your needs. You can get all the superior Putnam cutting qualities for milling: intricate shapes, deep cuts, tough materials, aluminum, etc. – without purchasing costly specials.

Contact your local Putnam Distributor, he will recommend the best end mill for each specific job and give you quick delivery from his stock.

ON THE BIG JOBS—Putnam Postiv-Lok will cut your costs over 25% on end mills 1½″ in diameter and larger. Quick delivery from stock on diameters to 3″.

A plant that specializes in the manufacture of end mills

Putnam end mills are made by specialists who work in a modern plant having the finest equipment available. Every end mill is machined from high speed steels of rigid Putnam analysis, heat-treated in our own plant and produced under close quality control. Because *end mills are our business,* we carefully guard their reputation for quality and performance with individual inspection on a score of important details.

DISTRIBUTORS
IN CITIES
COAST TO COAST

SOPKO
Grinding Wheel ADAPTERS
TOOLROOM ACCESSORIES

FREE Catalog

- For Use on All Popular Surface Tool and Cutter Grinders
- Precision-made, Hardened & Ground with Heat Treated Nuts
- Complete Line—4 New Models of Adapters Available
- Large Stocks—Immediate Delivery

SOPKO ADAPTERS
Save Time and Money

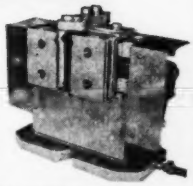
Write for CATALOG and PRICES

WM. SOPKO & SONS CO.
140 E. 267th ST. • EUCLID 32, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1051

LOOK! NO HANDS!

"SURE CENTER"
AIR VISE FOR ECONOMICAL PIECE PART CHUCKING



- Automatically self-centering.
- Precise and instantaneous operation.
- Good visibility and chip room.
- Holding force over 5,500 lbs. at 100 lbs. pressure.
- Also hand operated.

Get the facts. Write for bulletin.

HEUSER MANUFACTURING CO. 1642 N. Paulina St. Chicago 22, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1052

LEAD HAMMERS—Buy Cook "SHUR-GRIP"

They're a MUST in every shop where many blows have to be struck without marring surfaces. Available with "SHUR-GRIP" drop forged handles.

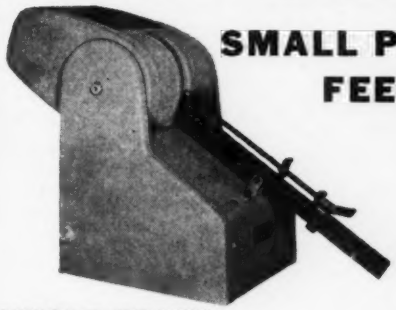
Write for circular and prices

COOK'S LEAD HAMMER SERVICE
68 Massasoit Ave., E. Providence 14, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 1053

The Inform-A-Gram Card which follows page 84 is for your convenience in making inquiries about advertised products and editorial articles.

HOPPERAL



SMALL PARTS FEEDERS

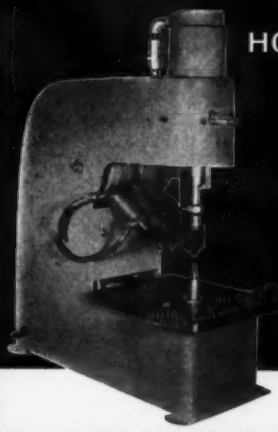
SINGLE TRACK

Automates your operation by continuously supplying parts which are properly oriented for machining, assembly and packaging. Gentle oscillating action of "HOPPERAL" assures trouble free feeding of parts. Unit shown has adjustable escapement to release one or more parts at a time.

REDUCE ASSEMBLY COSTS

MULTIPLE TRACK

Available with any number of tracks to feed parts to assemblies or other operations where a large quantity of parts is required simultaneously. Can be partitioned and supplied with properly designed tracks to feed unlike parts.



HOPPERAL DRIVER

A bench press with built-in parts feeder to provide a continuous supply of small parts properly oriented for staking, press fitting, peening and riveting.

The Hopperal parts feeder will feed screws, nuts, bolts, rivets, nails and other fastening devices for many assembly operations.

Write for brochure on automated feeders and assembly machines.

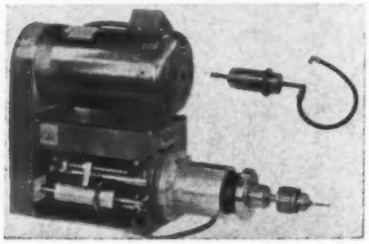
HABERSTUMP-HARRIS, INC.
10463 NORTHLAWN AVENUE • DETROIT 4, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 1054

Product News

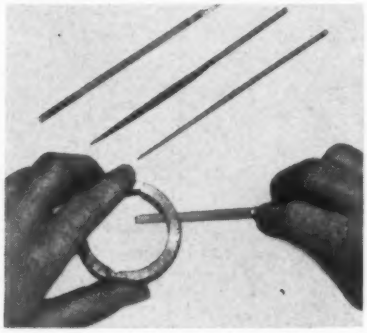
Lends Versatility

Users of Series 28 Dumore Drill-N-Tap units can now automatically drill and tap in one operation with combination tools. A new control accessory facilitates rapid changes in tool sizes and materials. Once adjusted, it provides uniform thrusts cycle after cycle. Advance



and retract feed rates of Series 28 units can be easily adjusted to match tap lead, without pulling out the last thread on tool withdrawal. The new control accessory lends greater flexibility, reduces costs, increases production, and saves space, according to The Dumore Co., 1300 Seventh St., Racine, Wis. Request Bulletin DNT-61, or circle Inform-A-Gram No. P6.

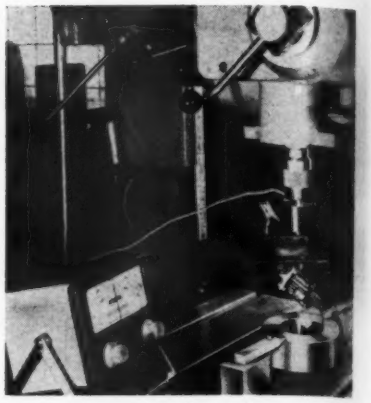
Diamond Needle Files



There's a new line of diamond needle files at Titan Tool Supply Co., Inc., 68 Comet Ave., Box L, Buffalo 16, N.Y. The files are recommended for sharpening, cutting and dressing hardened steel dies, carbide, ceramic and other superhard materials. Files are available in 12 different shapes in conventional hand file design. They're mounted on a mandrel for use on hand filing machines. Grit sizes are 200/240 fine, for polishing; 120/160 medium for general utility use; and 80/100 coarse for more rapid material removal. Write the makers, or circle Inform-A-Gram No. P7.

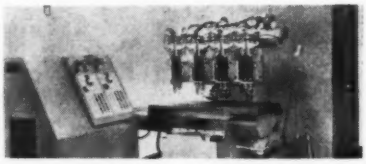
Center Finder

Model 230 P-56 electronic gage centers holes or cylindrical forms under various types of machine spindles. It's also useful to check spindle runout, or to explore taper, bellmouth, squareness, roundness, concentricity, etc. A rotary connector allows the gage head to rotate freely with the spindle while the cable to the amplifier remains stationary. The unit is made by Federal Products Corp., Providence, R.I. Several magnifications are available; highest is 5500:1 with 0.000020 graduations. The amplifier and gage head can be



used separately for other gaging jobs. Circle No. P9.

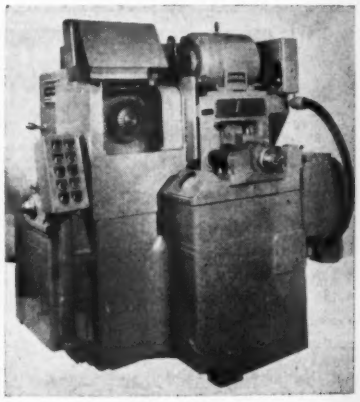
Four-In-One Drilling



A four-in-one drilling unit is designed to drill printed circuit boards of various materials and thicknesses. It's numerically controlled with a General Electric Mark II. The machine has a tape-controlled point positioning table and four drilling clusters, each with four independent air feed drill units. The driller operates at 50 cycles/min, and drills four boards at once, or 200 holes/min. Drills are operable at different speeds up to 22,000 rpm. Edlund Machinery Co., Dept. P-CB, Cortland, N.Y., also offers Model TPR tape programmer along with the drilling machine. Circle No. P10.

Gear Lapper

Model 503A hypoid lapper from the Gleason Works, 1000 University Ave., Rochester 3, N.Y. will be exhibited at the ASM Show. The unit is designed primarily for lapping automotive spiral bevel and hypoid gears and pinions operating at 90° shaft angle. New features assure positive control of tooth contact and superior finished quality. See the unit for yourself, or circle Inform-A-Gram No. P8.



Plenty Rings

Now the maintenance man can have a supply of O rings on hand. The Universal Select-O-Ring Kit II contains 180 rings in sizes from 1 to 25. They are packed on pegs that duplicate shafts on which they are to be used. The plastic packing case serves also as a measuring tool. A small gage is molded into the side of the kit for instant cross section measurement. Kits are offered by Packaged Merchandise Co. at half-the-price of rings if they were purchased separately.

Self Centering
BORE GAGE
with INTERCHANGEABLE GAGING HEADS

Will Repeat within 50 millionths of an inch
AN INEXPENSIVE, ACCURATE AND DEPENDABLE
INTERNAL COMPARATOR
WITH A LEVER-AMPLIFICATION PRINCIPLE

made by Mahr

SMALL BORE GAGES — With interchangeable, spring loaded, Split Jaw Measuring Heads.

Range	.059 to .160"	$110.00
"	.160 to .280"	$ 76.75
"	.280 to .400"	$ 76.75

LARGER SIZES — With a springloaded bridge, as illustrated.

Range	.400 to .700"	$76.75
"	.700 to 1.400"	$73.50
"	1.400 to 2.400"	$73.50

MAHR THE MOST COMPLETE LINE OF BORE GAGES

Complete in Hardwood case, without gaging head. Additional charge for gaging head reading in .000050" .... $37.50.

Also available: • Heads Reading in 20 millionths or 5 tenths • Gages for holes to 32" dia. • Gages for hole depths to 88". Precision Comparator Stand for checking of mass-produced small parts • Right-Angle Bore Gages for hard-to-measure places • Tungsten Carbide tipping of contact points.

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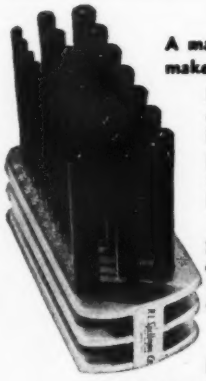

SPELLMACO SPOTTERS

A matched set of transfer punches for tool makers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand — sizes 3/32" to ½" by 1/64" plus handy 17/32" size—length 4⅞". PRICE only $19.40

Single sizes available.

R. L. SPELLMAN CO. • Urbana, Ohio

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TUMBLING MEDIA
for Deburring and Finishing

Preforms in over 300 shapes, sizes and bonds for all barrel and vibratory operations.

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- No "roll-over" of burrs
- Minimum media fracture
- Maximum production

Free lab service reports proper media for your parts.

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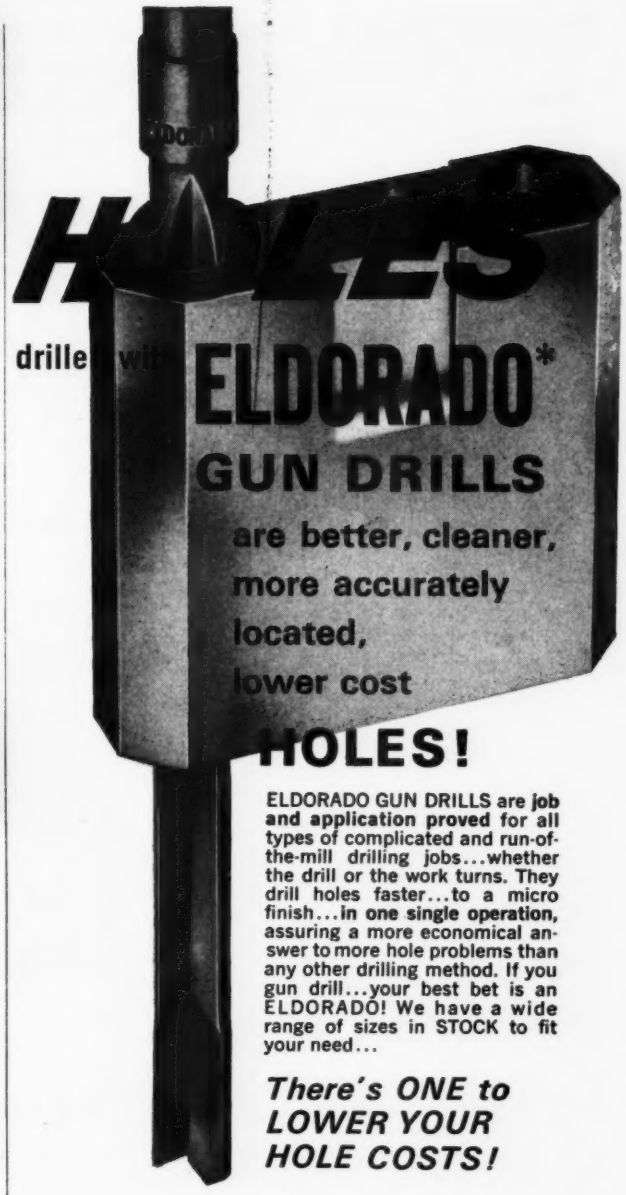
Phone GR 9-3621

CIRCLE INFORM-A-GRAM KEY NO. 1073



HOLES drilled with ELDORADO* GUN DRILLS are better, cleaner, more accurately located, lower cost

HOLES!

ELDORADO GUN DRILLS are **job and application proved** for all types of complicated and run-of-the-mill drilling jobs...whether the drill or the work turns. They drill holes faster...to a micro finish...**in one single operation,** assuring a more economical answer to more hole problems than any other drilling method. If you gun drill...your best bet is an ELDORADO! We have a wide range of sizes in STOCK to fit your need...

There's ONE to LOWER YOUR HOLE COSTS!

ELDORADO'S specialized Engineers and research facilities are available to assist you in the selection of the right gun drill tool or drilling method to solve special hole drilling problems.

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NOW AVAILABLE FROM STOCK
ALL SOLID CARBIDE TIPPED
Dias. in every 1/64" increment

Size-Dia.	LENGTH	Driver
.1250" to .5000"	10", 16", 22"—all dias. 28", 36"—most dias.	¾" x 2¾"
.5156" to .7500"	16", 22", 36"	1" x 2¾"
.7656" to 1.0000"	22", 36"	1¼" x 2¾"

IMMEDIATE SHIPMENT

Also custom made Gun Drills in all dias. up to 2" in any length within dia. limits —ON NORMAL DELIVERY

Specializing 100% in Gun Drills and Related Tools.

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356 BOSTON POST ROAD • MILFORD, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 1074

Product News

Metal Treating

A new compact 2 cu ft 130° refrigeration machine is ideal for treating, shrinking, testing or as a "roving shortstop." The unit is mounted on rolling casters and is ready to work as soon as it is connected. It is protected against pressure build-up in case of power

failure. Harris Mfg. Co., Inc., 308 River St., Cambridge 39, Mass., will also exhibit the standard 10 cu ft machine model that features the Cascade refrigeration system with cooling capacity of 1000 BTU/hr to 5000 BTU/hr at 100°F. Write the company for case histories, or circle Inform-A-Gram No. P11.

PM Drills

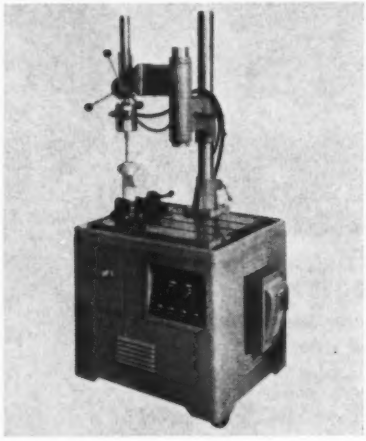
These drills offer margins through one inch and triple margins over an inch. They support the drill bushing and improve hole location. Drill point accuracy is guaranteed to 0.003 through 1½", or 0.004 TIR over 1½". Straight and taper web provide maximum drill strength and prevent most web thinning for the straight portion of the drill's flute length. Write Mohawk Tools, Inc., 910 East Main Street, Montpelier, Ohio, or circle Inform-A-Gram No. P12.

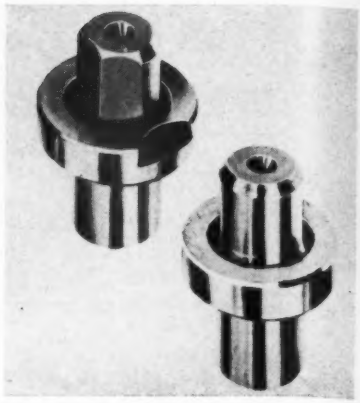
Host of Locating Pins

There are 368 sizes, ranging from ⅛ to 1½" head diameters, in a new line of locating pins. They come in both diamond and round styles, and are designed with a resting shoulder feature. This permits pins to serve as rest pads. The pins are used in bushing applications. Both diamond and round shaped styles are carburized, and hardened to Rc 60-62 for tough wearing surface with a mild core. Write Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, Ohio, or check No. P13.

Disintegrator

This new unit's superstructure



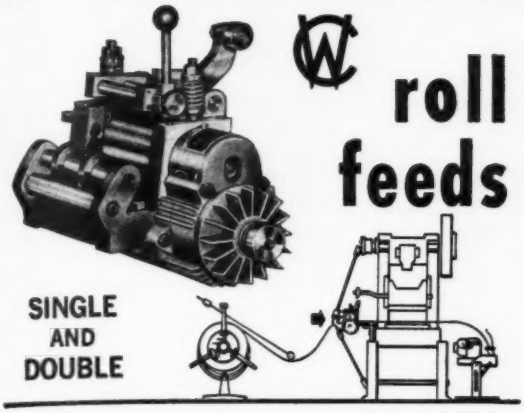


is made of Tenzaloy and weighs a mere 40 lbs. The new radial arm is long enough to sweep the entire area of the top plate. It's precision machined for extreme tolerances. It locks and remains locked at the touch of a finger. It consists of two separate sections that buckle together for close work, or open up for extension. One section can be removed for particularly close work. An extra section can be added to allow for an additional 10" reach. The disintegrating head adjusts to 90° for angular work. See this Model C-2 at the ASM Show Jiffy Tool Supply Co. booth. Or write Jiffy at 1503 East Eleven Mile Rd., Royal Oak, Mich. Inform-A-Gram No. P14.

Cutoff Machines

Two abrasive cutoff machines will be exhibited at Beaver Pipe Tools, Inc., Dana Ave., Warren, Ohio. Model 11 is available as bench model, or with steel stand. It handles 3" shapes and 1½" solids. It has a 1" dia spindle with sealed ball bearings. Spindle speeds are up to 3450 rpm. It's 11" dia 1" bore spindle has holes for drive pins. The new Model 20 oscillating cutoff machine provides larger capacity quality cuts. It cuts most 6" shapes and 4 x 4" solids in seconds. It's equipped with air operated power head for a minimum of 30% longer wheel life and uniformity of cut. An air actuated chain-type V vise is standard equipment. Oscillation is controlled separately. With a 1" spindle diameter, it attains speeds to 2600 rpm. See both units, and the company's fully automated Model 14 at the ASM Show. Or circle Inform-A-Gram No. P15.

FOR HIGH PRODUCTION STAMPING



roll feeds

SINGLE AND DOUBLE

Cooper Weymouth Roll Feeds can push or pull coil stock into stamping presses at speeds up to 450 strokes per minute. Equipped with trouble-free high torque carbide clutch and disc type air cooled brake with twice the usual braking area. Fifteen standard sizes with feed length and stock width capacities up to 12".

Send for details on this and other Cooper Weymouth automatic production equipment for press rooms.

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- Give heights from ¾" to 2⅜" in ⅛" increments.
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- Cost only $7.50 per pair; $75.00 per 12 pairs, plus transportation costs. Shipping weight 3 lbs. 10 oz. per pair.

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By ..... Title .....
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on Work Holding Tools For Production, Tooling, Maintenance

Drill press vises, angle vises, swivel machine vises, rotary tables, lathe milling attachments, production vises, heavy duty angle vises and adjustable angle plates are illustrated and fully described in this new PALMGREN Catalog #208. It shows the *ONLY* complete line of work holding devices available anywhere. Designed for production, tooling and maintenance work, it shows over 70 different models and types, with jaw sizes from 1½" to 8". Ask for your FREE copy of this catalog today, it shows the complete line and prices.

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No. 2B Heavy duty 4" Angle Vise

No. 84, 8" Rotary Table

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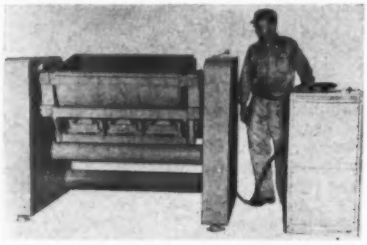
CIRCLE INFORM-A-GRAM KEY NO. 1093

Product News

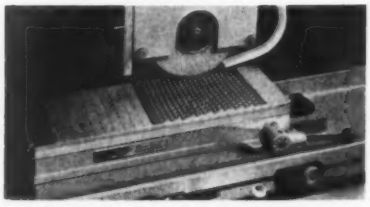
Fine Finishes

Interested in deburring, radii forming, descaling, cleaning and polishing of metal parts? Then you'll want to stop at the ASM Show exhibit of Globe Industries, Inc. This company's Vibrodyne Div., 125 Sunrise Place, Dayton, Ohio will show a Vibrodyne finishing machine. Units come in ⅛, 1, 2, 4, and 6 cu ft sizes. The design and operating principle is the same



for all units. The newest and largest is V-600, 6 cu ft. It features a resonant electro-magnetic system with shaking forces up to 50 Gs. There's only one moving part—the tub. Shaking force set by a single knob, from 0 to 5/16" amplitude. A continuous rotary turnover motion gives 100% scrubbing action between parts. The air-dumped tub is 37 x 20 x 15" deep and holds a 750 lb charge. More at the booth, or check Inform-A-Gram No. P16.

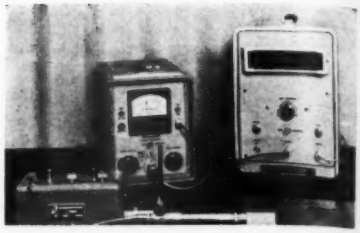
A Powerful Hold



Micro-Mesh 618-4 permanent magnet chuck with its barium-ferrite (ceramic-type) magnets, holds work as thin as 0.001. The chuck is credited with holding power of 2½ psi for a piece 0.008 thick. Because of this uniform holding power that extends over the entire magnetic surface, Micro-Mesh can be used fully loaded for maximum production. The unit has 6 x 18" working surfaces. Magnetic surface is 6 x 15¾". Complete data from Brown & Sharpe Mfg. Co., Industrial Products Division, Providence 1, R.I., or on No. P17.

Peak Counter

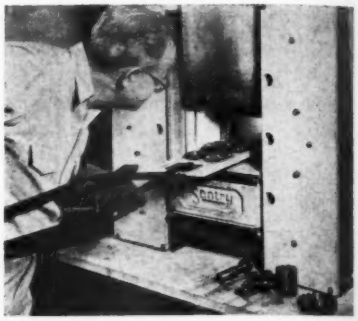
Measuring of both peak count and average roughness-height with a single combination of equipment presents a major breakthrough in surface texture measurement. The new Profilometer with peak counter allows for easy counting of surface irregularity peaks at a preset level. This inspection tool for quality control and production makes a close check on the surface uniformity possible. The Profilometer with peak counter can be set to read only the average-roughness-height or to read the



surface irregularity peaks simultaneously with the average roughness-height. See this and the Proficorder, and other precision measuring instruments in the ASM Show booth of Micrometrical Mfg. Co. Or write them at 345 S. Main St., Ann Arbor, Mich., Inform-A-Gram No. P18.

Scale-free Hardening

ASM Show visitors interested in heat treatment of air-hardening, high-carbon high chrome, and high speed steels should stop at Booth 930. Here, the Sentry Co., Foxboro, Mass. will operate Model Y electric furnace to demonstrate scale-free, decarburization-free hardening on "moly" high speed steel. Sentry Diamond Blocks create a positive protective atmosphere for high carbon high chrome and high speed steels. Tools can be "soaked" in the Sentry Block atmosphere to assure full hardness without



danger of surface deterioration. Visitors are invited to bring samples of their high speed steel tools for demonstration hardening. Inform-A-Gram No. P19.

Rapid Tap

A new non inflammable, non-explosive metal cutting fluid—Rapid Tap—is recommended for tapping, reaming, drilling, boring, threading, lathe cutoff, profile milling. It's said to make tapping easier and faster. It releases stuck taps, stops tap breakage, increases thread accuracy, and improves surface finish. It will be shown at the ASM Show booth of Relton Corp., 99 N. Lotus Ave., P.O. Box 5546, Pasadena, Calif. Or No. P20.

Accurate Measure

DR-25B optical gage measures parts directly without gage blocks or master setups. It's accurate to 0.000025 and operates within the 50 to 90° temperature range common to industrial areas. There's no need for temperature adjustments. A precision ruled scale is part of the unit. This makes it ideal for measuring various dimensions on any one part. Precision measurements can be made from 0 to 3". The maximum correction for a 3" dimension in steel is only 0.0001. Optical equipment includes serrated anvils. Bulletin D-285 from Bausch & Lomb, Inc., Rochester 2, N.Y., or Inform-A-Gram No. P21.

Punches and Dies

...for foot and power presses

Standard Punches and Dies of all sizes and shapes in stock—or made promptly to order. Also Adaptors and Die Shoes to convert your press. For power, foot or hand operation.

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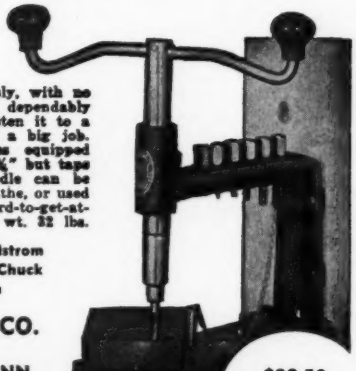
... Adapts for LATHE USE

THE DAHLSTROM TAP GUIDE virtually eliminates tap breakage—and saves those costly hours spent prying broken taps out of dies. Anyone can use it. Just a few turns of the spindle and the job is done.



Winds through continuously, with no backoff. Work is always dependably straight and square. Fasten it to a post or set it on top of a big job. This handy tapper comes equipped with 9 adapters, 8-32 to ¾" but taps are not furnished. Spindle can be pulled out and used in a lathe, or used as tap extension for hard-to-get-at-places. 13" x 8" x 14", wt. 32 lbs.

Also Makers of Dahlstrom Autostrop and Tap Chuck
Send for bulletin

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Now, with more than fifty models in the Dustkop line—plus efficient accessory items—the odds are that a standard unit will solve your problem. Dustkop units solve other problems too. They're easier to install, save space and money and are virtually maintenance-free!

how to select a dust collector

This new brochure includes all basic information needed to select the right dust or mist collector for grinding, buffing, polishing and other types of service. Write for your copy. No obligation.

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1394 Church St., Adrian, Michigan

DUSTKOP STOPS DUST

CIRCLE INFORM-A-GRAM KEY NO. 1113

91

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- Any length column
- Any length stroke
- ¼, ½, ¾, 1 Ton capacities
- Special adaptations available

ONE MANUFACTURING SOURCE FOR PNEUMATIC AUTOMATION COMPONENTS

- Cylinders
- Presses
- Valves
- Filters
- Regulators
- Lubricators
- Fittings
- Hose

Air-Mite Production Air Presses are ruggedly built for high production applications. Solid steel column for greater strength and rigidity; compact, powerful cylinders have long, maintenance-free construction features that insure uninterrupted service. Available with a variety of controls for fast, safe operation. Press shown is equipped with two Air-Mite 3-way valves — 1 normally "closed", 1 normally "open." Cylinder will not return for second stroke unless both valves are released.

Write for complete Air-Mite catalog which illustrates and describes the Air-Mite line.

AIR-MITE DEVICES, INC. 4405 A W Kinzie St., Chicago 24, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1114

DISCONNECTS PSC AIR GASES FLUIDS

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PSC QUICK DISCONNECTS give you the fastest, easiest and most economical means of connecting or disconnecting supply lines.

FAST, SIMPLE, one hand connect or disconnect. Automatic locking forms a high pressure, leak-proof connection.

ONE HAND OPERATION

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SERIES "A"—a small, compact Coupling. Pushomatic one-hand automatic locking. Maximum flow. Full swivel action. Integral shut-off valve. Four end types—⅛" thru ¾" N.P.T.

SERIES "D"—Interchangeable with all popular makes. Same construction as "A" series. Interchangeability reduces costly Coupling inventories.

SERIES "E"—a straight-thru type—permits unrestricted flow—has same inside diameter as nominal supply pipe or hose. Permits fast transfer of media.

SERIES "G"—double shut-off two-way check valve stops the flow from both lines when disconnected. Ideal for pressure loading of gases and fluids.

PSC QUICK DISCONNECTS are the fastest, easiest and most economical means of making or breaking a connection. Less down-time—more production time.

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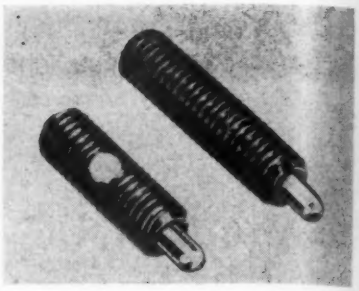
Baltimore Buffalo Chicago Cleveland Camden Los Angeles
New York Providence Montreal Toronto Canada

CIRCLE INFORM-A-GRAM KEY NO. 1121

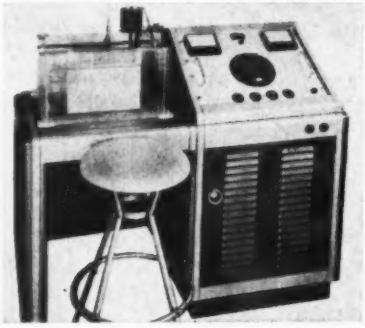
Product News

No Crystallization

A new line of spring plungers features a specially compounded and treated spring. It's said to eliminate crystallization. The plungers are used for positioning parts in jigs and fixtures. When compressed, the spring allows the plunger to recede entirely into the threaded body. Plunger tips can be ground for specific needs without weakening. Jergens Tool Specialty Co., 712 East 163rd St., Cleveland 10, Ohio, offers each model in 10 sizes from 5/32 to 1". Inform-A-Gram No. P22.



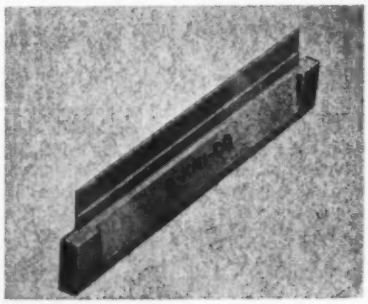
Plating



Model 500 electroplating unit from Allen Aircraft Products, Ravenna, Ohio, is ideal for experimental or short-run plating or anodizing. It lends itself for applying copper stop-off plate in case-hardening, or build-up of worn parts with hard chromium plating. The desk-size unit handles all plating. It can be used for hard-anodizing aircraft and missile components, electrochemical milling, electropolishing, electrolytic cleaning and etching. See the unit at the ASM Show, or write the makers at the above address. No. P23.

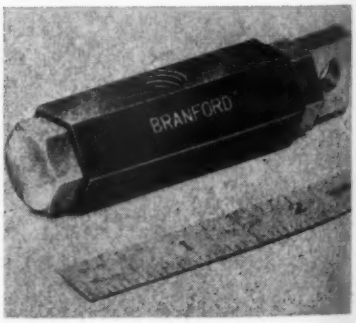
Grinder Blades

Centerless grinder blades are equally efficient for straight production runs and short runs with frequent changes. Blades are available for thrufeed and infeed grinding on all types of centerless and double disc grinding. Diameter range from 0.060 to 6". In addition to standard thrufeed and standard roller infeed blades for work lengths from 4" to 18', centerless grinder blades are also available for grinding small diameter work, such as needle bearings, and small drills. Inquire at Ohio Knife Co., Dreman at B & O RR, Cincinnati, Ohio, or Inform-A-Gram No. P24.



Midget Vibrator

Vibrajust midget vibrator is recommended for use where magnetism from electric vibrators is intolerable, and where a low noise level is essential. Model 7803 with a reciprocating piston is lightweight. It operates at high frequency with little air. It's workable at 10 psi line pressure up to 80 psi, with a frequency range between 6000 and 18,000 vibrations/min. Recommended operating range is 10 to 20 psi for a low noise level. Write the Branford Co., Div. Electro-Mechanics, Inc., 130 Glen St., New Britain, Conn., or circle Inform-A-Gram No. P25.



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Light weight and thin design encourage use on regular drafting board, permit unit to be stored with reference books, ready for next user. It **pays for itself** in a short time.

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- can be used to trace on bristol board, Multilith and Mimeo mats, or to strip in and opaque negatives
- PORTA-TRACE fits under parallel rule on drafting board or may be supplied with locking T-square, other attachments. Flush top permits use with drawings larger than unit
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PORTA-TRACE INC.

Dept. TP, 50 Wall St., Binghamton, N. Y.

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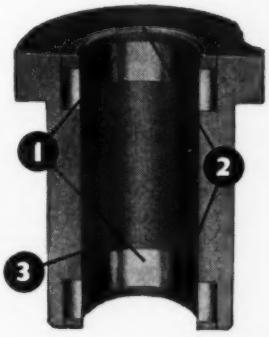

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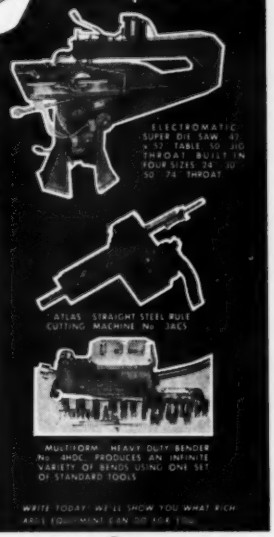
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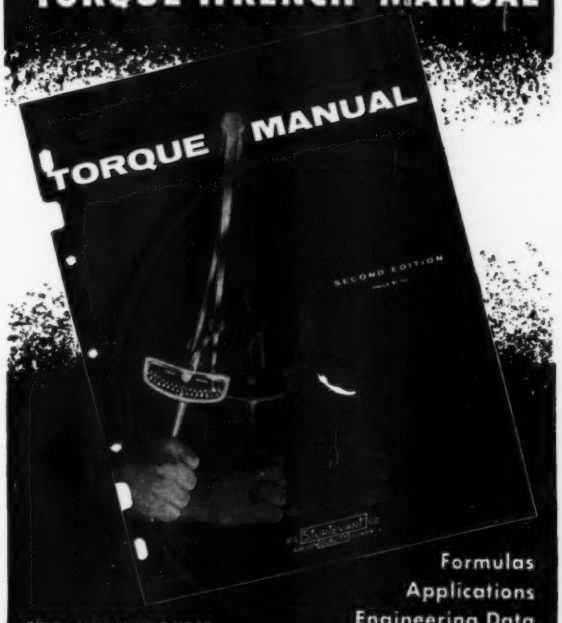

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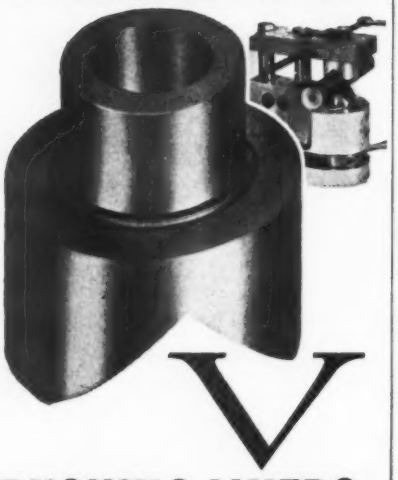

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from ACME INDUSTRIAL

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Available in 2 sets of 3 V bushing liners to accommodate slip bushings with O.D.'s of 3/16", 5/16" and 1/2" in a range from No. 80 drill to 11/32" in A.S.A. or Acme standard sizes. Acme V bushing liners . . . a must for every tool box.

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CIRCLE INFORM-A-GRAM KEY NO. 1141

Product News

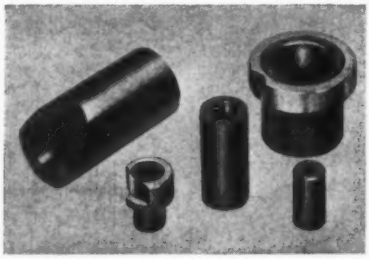
Safe Cutoff

A new heavy duty safety-enclosed cutoff machine for laboratory or production work will be shown by Buehler Ltd., 2120 Greenwood St., P.O. Box 830, Evanston, Ill. The 10-1030 AB cutter for 10″ abrasive wheel cuts metal up to 1½″ dia. The unit has a cast metal underwater cutting compartment, mounted on heavy pressed steel floor cabinet with built-in 15 gal recirculating coolant system. Accessories include a swivel vise for angle cutting of bar stock up to 1¼″ dia, and a

quick acting vise for gripping right hand side of material. See this at the ASM Show, or circle Inform-A-Gram No. P26.

Accuracy Plus

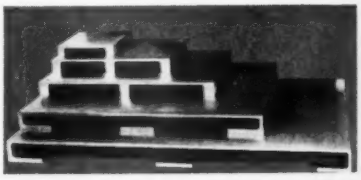
Initial outlay for tungsten carbide bushings may exceed that for standard ones, but application



economies offset this with decreased machine downtime. Carbide bushings are also hailed for repetitive hole accuracy over long periods of time. And they lend longer tool life. All these considerations were in mind when Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. added carbide bushings to its regular line. They now offer Ex-Cell-O and ASA stds., thin-walls, Trans-Lok, and Press-Lok with serrated OD's. Write the makers, or mark Inform-A-Gram No. P27.

Fixture Base

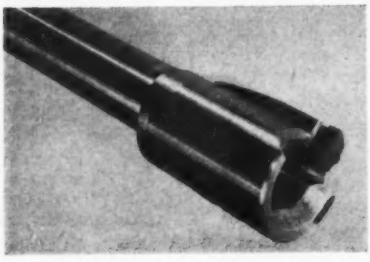
There are 142 sizes in a new line of aluminum fixture bases. Sizes range from 6 x 20″ through 28 x 68″. Bases are stacked and ready for shipment. Edges and sides are machined to provide efficient edge and end set-ups. Standardization provides uniform approach and improved appearance. Rust proofing is not necessary since bases are of Tenzaloy, a corrosion resist-



ant, self-aging, high strength aluminum alloy. Tensile strength is 35,000 lbs and yield strength 26,000 lbs. See these bases at the ASM Show in the Artco, Inc. booth, or write Artco at 31985 Groesbeck Hwy., Fraser, Mich. No. P28.

Holes In One

New trepanning tools produce holes from the solid in one pass. The tools can be used on turret



lathes, boring mills, drill presses, gun lathes or special turning machines. The units are available in any diameter from 2″ up. They come with ID or OD exhaust for use with or without coolant conductor. Bits are stocked in high speed steel, carbide or tantung. Pre-ground wear pads are also available from stock. Contact Muskegon Tool Industries, Inc., 11th at Western, Muskegon, Mich., or check Inform-A-Gram No. P29.

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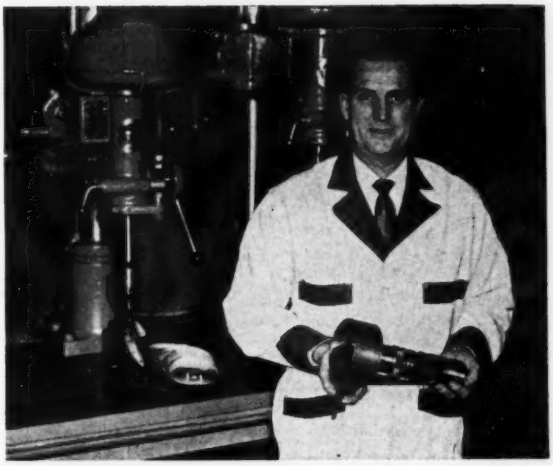

"This Bokum recess tool and holder increased our production by 608%"

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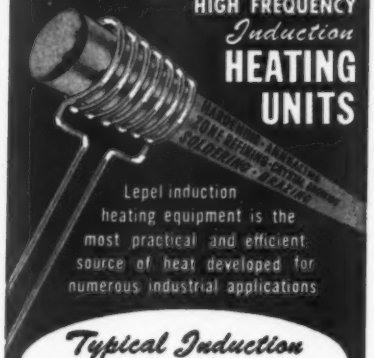
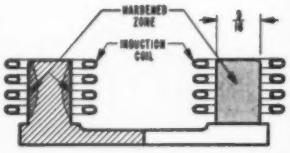


Lepel induction heating equipment is the most practical and efficient source of heat developed for numerous industrial applications

Typical Induction Heating Applications

Steel Bosses Selectively Hardened



Bosses on part shown are locally hardened to increase resistance to wear and plastic yielding. Surface hardening by induction provides hardness pattern indicated and hardness of Rc 57/59 for 1040 steel when quenched in water.

Our engineers will process your work samples and return the completed job with full data and recommendations without cost or obligation.

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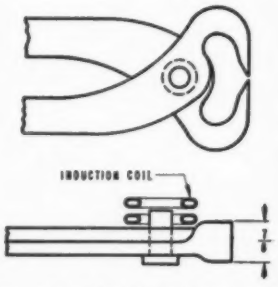

The ends of high-strength steel rivets are selectively heated to 1700° F for hot upsetting. Design of coil permits movement of upsetting tool through the coil.

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55th ST. & 37th AVE., WOODSIDE 77, N. Y.

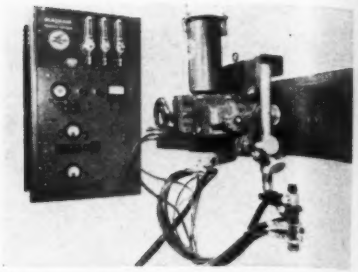
CHICAGO OFFICE: 6246 WEST NORTH AVE.

CIRCLE INFORM-A-GRAM KEY NO. 1161

Product News

Weld Surfacing

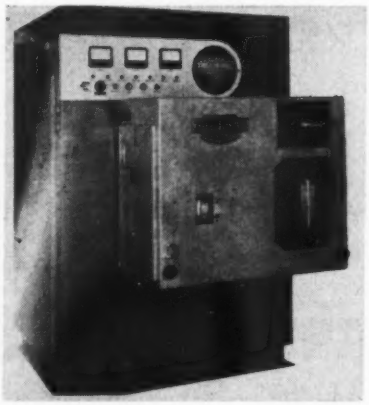
The new Plasmarc weld surfacing is a sister process to Plasmarc cutting, introduced several years ago. Plasmarc weld surfacing produces fully-fused overlays of wear- and corrosion-resistant alloys. The overlay metal or alloy is fed as a powder into the Plasmarc torch. Intense heat is created by the combination of a plasma jet, produced within the torch, and a constricted arc transferred from the torch to the work. Argon gas is used to form the plasma, and also shields the surfaced area from atmospheric contamination. With



the new equipment, penetration of the overlay into the base material is held to a minimum of 0.005, or as high as desired. Dilution of the overlay with the base can be controlled to 5% or up to 50%. See this process demonstrated in ASM Show booth of Linde Co., Div. Union Carbide Corp., 270 Park Ave., New York 17, N.Y. Inform-A-Gram No. P30.

Dual Frequency Induction

A new dual frequency induction generator can induce the equivalent of 50 kw into a square inch of surface. The unit's shallow penetration depth at normal operating frequencies (5 to 8 megacycle range) permits efficient coupling of high power to small diameters. Output control of all frequencies is by saturable reactor, featuring line regulation, fast response, and manual or automatic control. A 200 kilocycle output station, with a variable transformer and direct tank loading, insures maximum utility. Selection of kilocycle or megacycle output is made by a manual transfer switch. Change-over from transformer to direct tank loading is made by shifting links. Write Induction Heating Corp., 181 Wythe Ave., Brooklyn, N.Y., or check No. P31.



Relief Grinder Points Drills

A new floor model relief grinding machine does double duty. It works as an ultra-precise drill point grinder and also as a versatile cam relief grinder. As a drill point grinder it grinds original points, and resharpens virtually any style drill point. This includes split crankshafts points, helix-points or spiral points, chisel or conventional, sheet metal, three and four lip core-drills. As a cam relief grinder the unit works rapidly, with eccentric relief. It grinds step drills, taps, countersinks including uniflutes, center drills, double margin drills, sub-land drills, porting and valve seating tools, and special forms and contours. Work range is from 1/64 through 1 1/32", left or right hand. Write Harig Mfg. Corp., 5757 W. Howard St., Chicago 48, Ill., or circle Inform-A-Gram No. P32.

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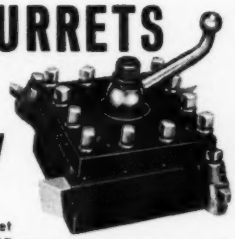

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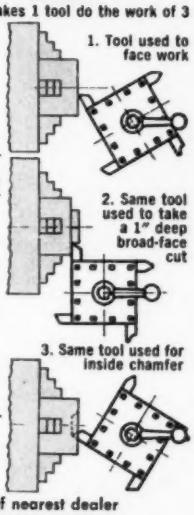

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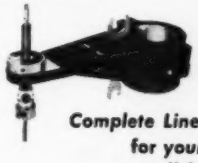

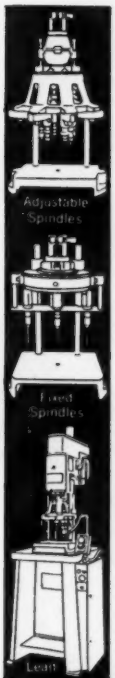

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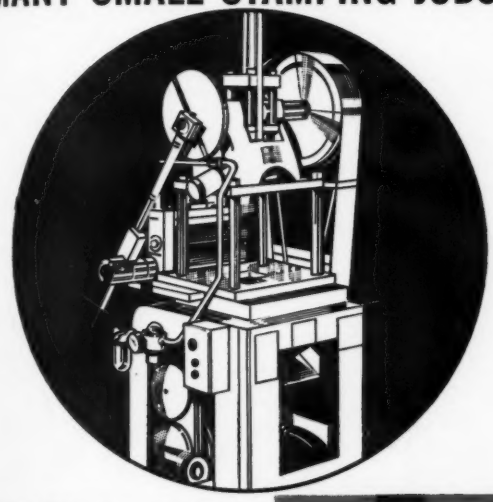

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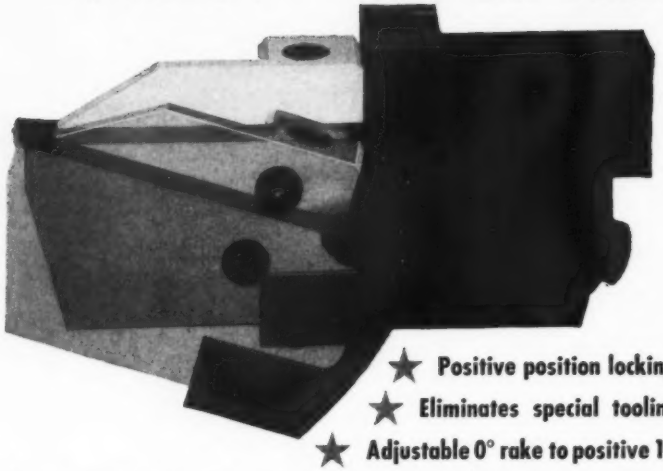

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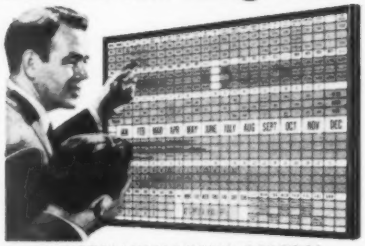

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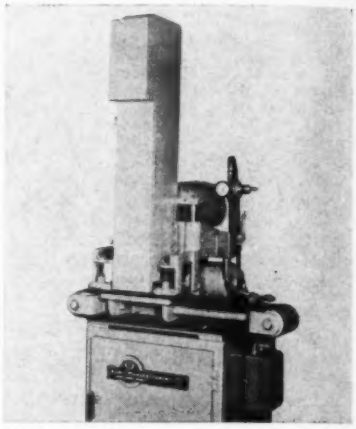
CIRCLE INFORM-A-GRAM KEY NO. 1183

Product News

Automatic Finishing

Floor Model JC abrasive belt finishing machine performs flat grinding, deburring and polishing on bars, strips, blanks, stampings, forgings, die castings and sand castings. The unit has a motorized conveyor belt that carries the work under spring-loaded holddown rollers and the abrasive belt contact wheel. Multiple head assemblies can be mounted in tandem



along one long conveyor belt to perform high production progressive finishing operations. The belt is pneumatically tensioned. Other features include positive manual or automatic belt tracking, micrometer grind pressure adjustment, V-belt drive to permit belt speed changes and infinitely variable belt feed control. See this in Booth 263 from Acme Mfg. Co., 1400 E. Nine Mile Rd., Detroit 20, Mich. Or circle No. P33.

Size Your Own

Nylon and fiberglass 5C collets are lauded for gripping power, flexibility, and excellent protection for fine finishes. Since they're adaptable to any size or shape in minutes, they're well suited for second operation work. To complete blanks, collets are seated directly on spindle and bored to size. Coolants or heat will not affect Nylon and fiber blanks. Write Production Machinery Sales, 2815 W. Burbank Blvd., Burbank, Calif., or mark No. P34.

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free 84-PAGE CATALOG

One Complete Source of Detailed Specifications for Designers, Production Managers, Toolroom Foremen

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JERGENS TOOL SPECIALTY CO.

Dept. TP-10, 712 E. 163rd St., Cleveland 10, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1191

New ARMSTRONG "90" SERIES RATCHET

The ONLY Ratchet with ALL these important features!

1 Slenderized head
2 Thumb-operated reversing lever specially designed so it won't come off
3 Reversing-lever stop (Ball-and-spring prevents accidental shifting)
4 Simple to clean—only tool required is a Phillips screwdriver (wearable parts may be individually replaced)
5 Thin handle with knurled grip
6 Hole in handle for convenient hanging
7 Fine-toothed gear
8 Easy ratcheting action
9 ¼", ⅜" and ½" square drives (two handle lengths on ½" drive)

All wearable parts are replaceable; individually, inexpensively, easily. With no teeth cut into handle, it need never be replaced. ●"ARMSTRONG" on these ratchets guarantees: advanced design, top quality and tool sense.

Extra heavy duty "50" Series ARMSTRONG ratchets (see right) in 1", ¾", ½" and ⅜" square drive sizes. Our General Catalog 700, gives complete information on these and approximately 5500 other ARMSTRONG tools. Your local ARMSTRONG Distributors will supply you a Catalog and demonstrate the new ratchets. If you don't know who he is, write us for his name.

ARMSTRONG BROS. TOOL CO.

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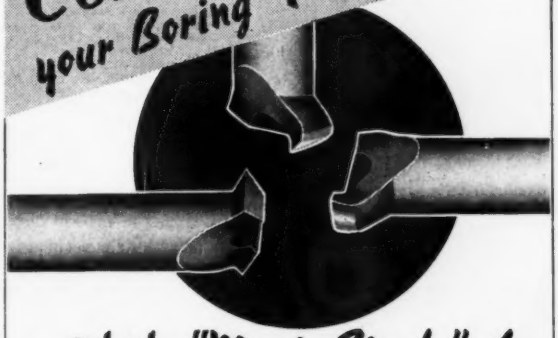
CIRCLE INFORM-A-GRAM KEY NO. 1192

Comet® solves your Boring Tool problems



with the "Magic Circle" of

Comet® Boring Tools

(H.S.S. & Carbide) for holes from 1/16" upward

Standard and Special Boring, Facing and Internal Threading Tools. Write for Data.

Bore Small Holes? Contact COMET!

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PREBCO BUSHING CO.

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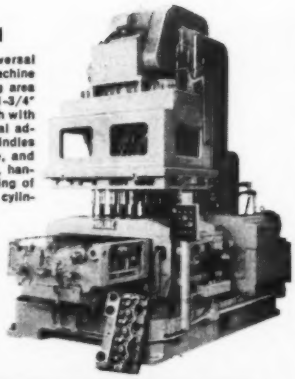
CIRCLE INFORM-A-GRAM KEY NO. 1194

HD13

straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.

MODEL HU111

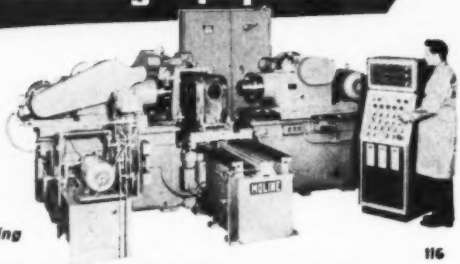
Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 50" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in slip spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder heads.



MOLINE Cost Reducing Equipment

MODEL MR148

Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.



60 years of Machine Tool Engineering Experience is at your service for 116

- Multi-Spindle Boring • Single and Multi-Spindle Honing
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- Special Multiple Operation Machine Tools *Write for Details*

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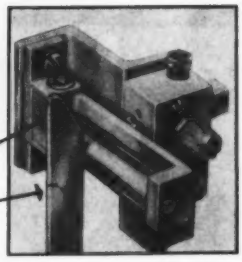
CIRCLE INFORM-A-GRAM KEY NO. 1201

Controlled LUBRICATING for punch press stock



Stock Lubricating— most modern, efficient lubricating method—now available for all punch press operations. Specially designed, cam controlled valve permits easy installation of lubricating unit on any standard press. The up and down stroke of the press ram controls on and off delivery of lubricant through an extremely small nozzle directly to the fabricating operation. Properly applied lubricants guarantee longer die life—greater production and piece part accuracy—plus considerable savings in time and labor.

Learn how automatic lubricating can help you — write for complete details.

Mistic Mist

AETNA MFG. COMPANY

198 S. York Road • Bensenville, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1202

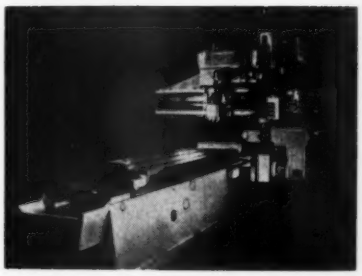
Product News

Automated Cleaning

Now cleaning procedures are automated with AutoSonex. The units feature an air feedback solvent control system that revolutionizes the use of such solvents as Trichlorethylene. It maintains own solvent or water level and automatically

distills solvent to keep it continuously clean. The AutoSonex machines will be shown in the Multi-Wheel 36-6 and Mono-Wheel 18 models that virtually eliminate internal wear since there are no friction points, nor internal bearings. See them at the ASM Show, or write AutoSonics, Inc., 4217 Chestnut St., Philadelphia 4, Pa. Inform-A-Gram No. P35.

Handymill

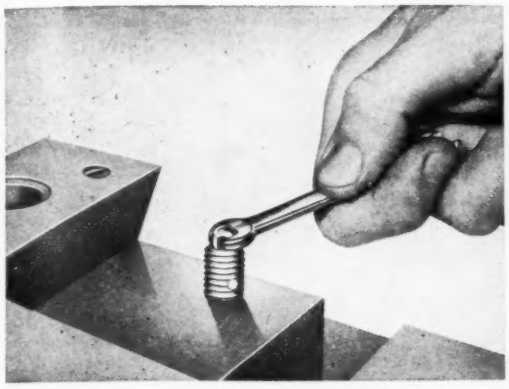


This small milling machine fills the need for a budget-priced unit to do production work and job shop assignments. It's simply designed and allows for the addition of standard attachments. This individual rugged milling machine comes complete with one rail milling head. A new drive unit and gear ratio permit table and rail feeds from 1-40 ipm over an infinite full range. The Handymill comes in 30, 36, and 42" sizes from The G. A. Gray Co., Cincinnati, Ohio. Mark No. P36.

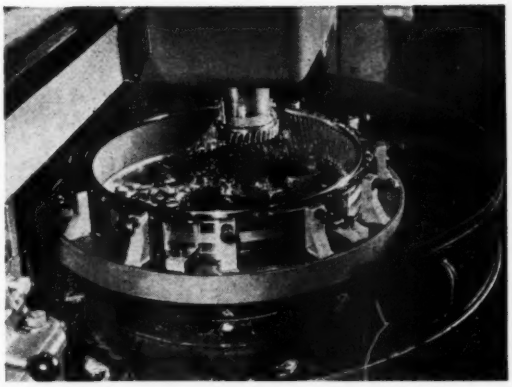
Practical Tooling Tips

No. 4 of a series

New uses are being found every day for Vlier Tooling Accessories. Perhaps the applications shown below will suggest ways you can profit by replacing costly, custom devices in jigs, dies and fixtures with precision, off-the-shelf Vlier products.



HEX NOSE SPEEDS INSTALLATION OF SPRING PLUNGERS—Vlier Hexnose Spring Plungers are easily installed with a simple end wrench. Eliminates hunting for special wrenches. Made to same exacting tolerances as Vlier Standard Spring Plungers. Available in many end pressures, diameters and lengths.



THIN-WALLED RING GEAR HELD SECURELY in fixture without distortion with 12 Vlier Torque Thumb Screws. Once pre-set end pressure is reached, knurled head spins freely, preventing overtightening. Checknut prevents backing off under vibration. Available in four types; various screw diameters and lengths.

SMALL, PRECISION, SPRING-LOADED BALLS provide controlled end pressures, won't bind from side thrusts. Sizes from 4-48 x 3/16" to 5/8-11 x 1". Various end pressures. Also available in all-stainless steel with Nylok.

FREE IDEA BOOKLET—Illustrations in this 16-page booklet show how others have profited from the use of Vlier Tooling Accessories. Shows both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

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PLUS the added benefits of "Teamwork Tooling", whereby the talents of many people are combined to effectively reduce your costs. "Teamwork Tooling" includes not only our engineering skills and modern manufacturing facilities, but also the capable services of our Suppliers, Stockrooms, Service Representatives and Distributors.

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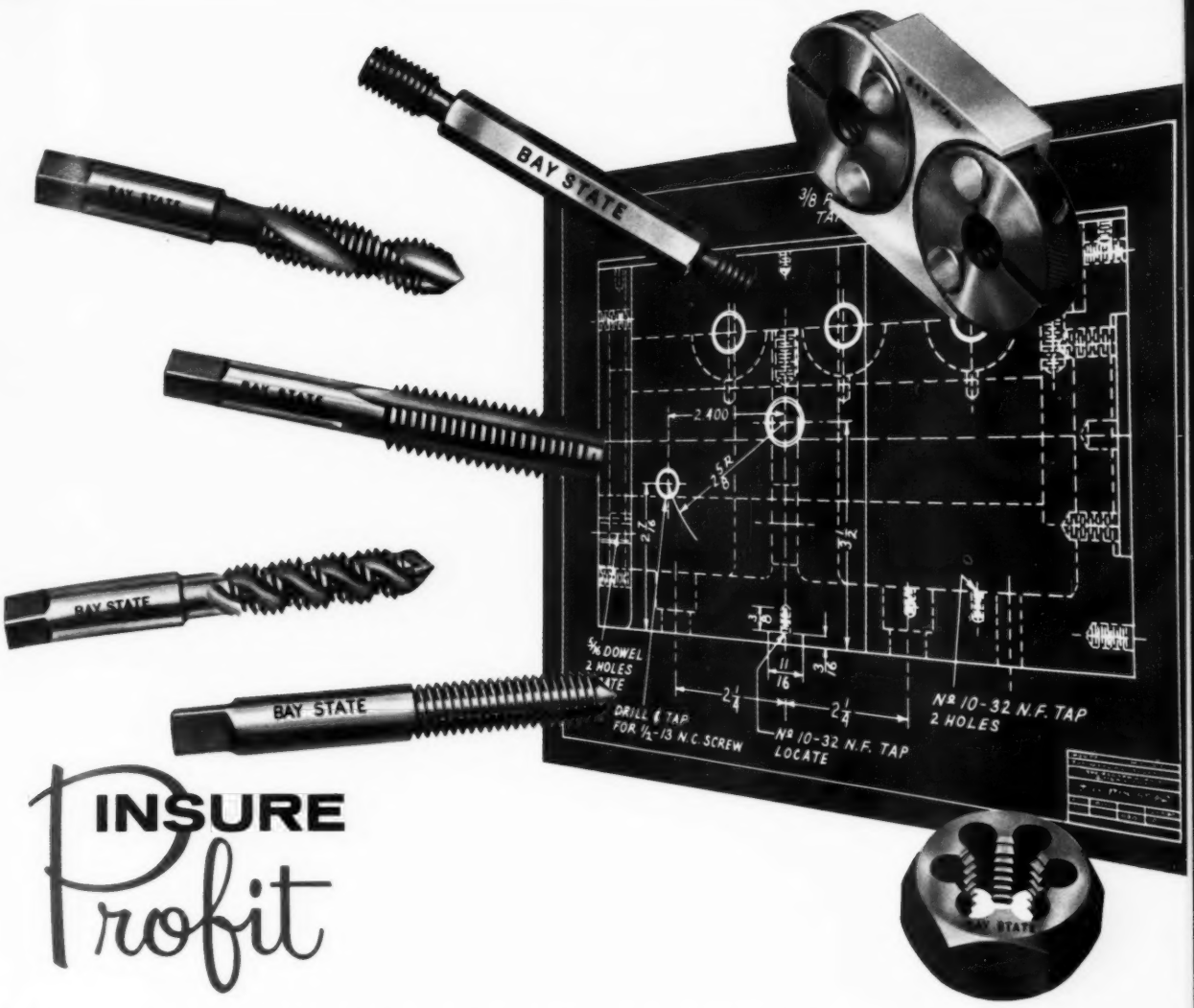
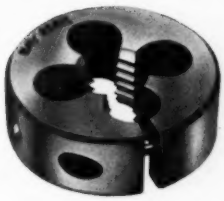


INSURE Profit

IN YOUR THREADING OPERATIONS



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PLUS our trained Service Representatives operating out of strategically located stockrooms to help you solve your thread cutting and gaging problems.

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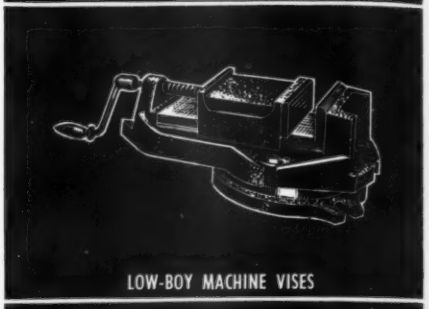
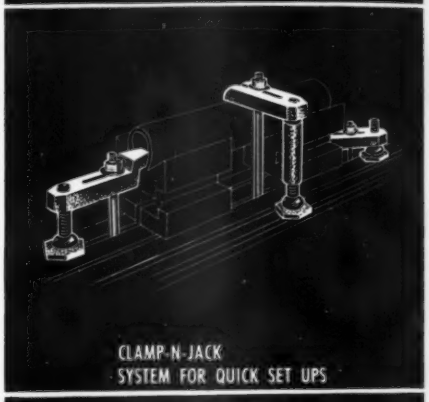
5 WAYS..... TO MAKE SET-UPS EASIER....QUICKER

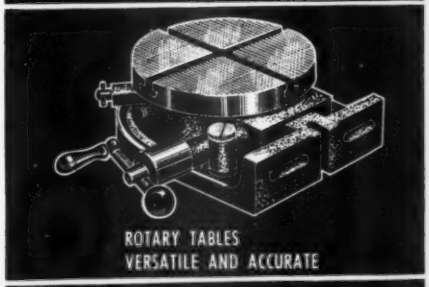
ADJUSTABLE ANGLE PLATES



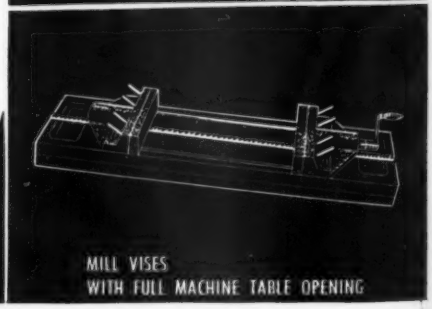
LOW-BOY MACHINE VISES



CLAMP-N-JACK SYSTEM FOR QUICK SET UPS



ROTARY TABLES VERSATILE AND ACCURATE



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for FASTER—SAFER—CHEAPER SETUPS

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- Give heights from ½" to 2⅝" in ⅛" increments.
- Cut setup time by eliminating haphazard blocking.
- Cost only $7.50 per pair; $75.00 per 12 pairs, plus transportation costs. Shipping weight 3 lbs. 10 oz. per pair.

ORDER TODAY. USE THIS COUPON.

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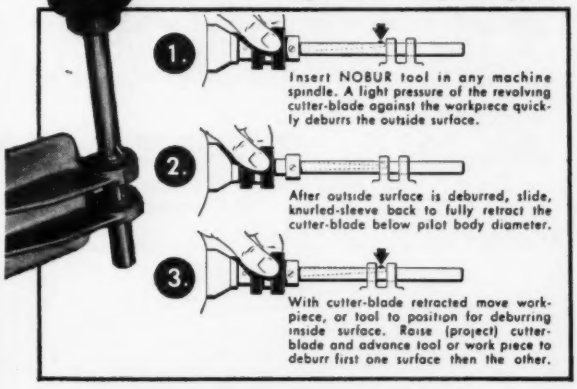
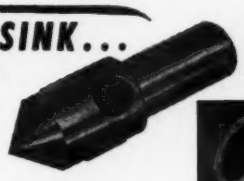


1. Insert NOBUR tool in any machine spindle. A light pressure of the revolving cutter-blade against the workpiece quickly deburrs the outside surface.
2. After outside surface is deburred, slide, knurled-sleeve back to fully retract the cutter-blade below pilot body diameter.
3. With cutter-blade retracted move workpiece, or tool to position for deburring inside surface. Raise (project) cutter-blade and advance tool or work piece to deburr first one surface then the other.

NOBURSINK...

a new approach to chatterless DEBURRING and CHAMFERING



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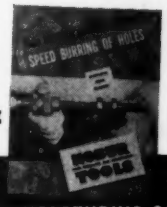

NO/BUR TOOLS **NOBUR** MANUFACTURING CO.

6860 Fairmont Ave. No. Hollywood, California

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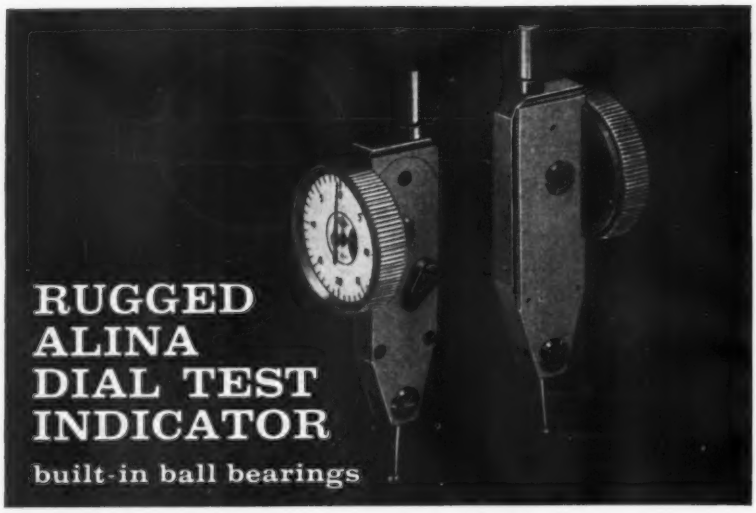

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- Reading 0-20-0 • Fully reversible contact point
- *Holder attaches to stem or to integral dove tails on body*

Available with a wide variety of rectangular or round shanks.

The instrument shown here is part of a complete line of precision DIAL TEST INDICATORS of all types — Write for brochure!

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122 East Second St., Mineola, L. I., N. Y.
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15"

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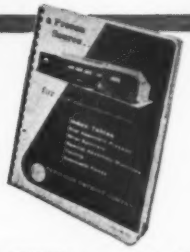
Standards:
*3, *4, 6, 8, 12
Specials:
*5, 7, 9, 10, 11
•skip station units



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"AUTOMATIC"
Geneva Motion Index Table

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PRECISION DETROIT COMPANY
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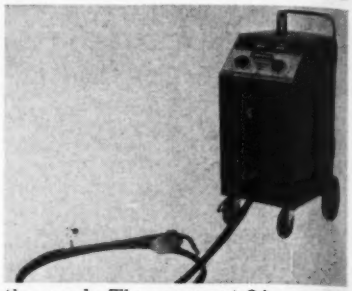
CIRCLE INFORM-A-GRAM KEY NO. 1262

Product News

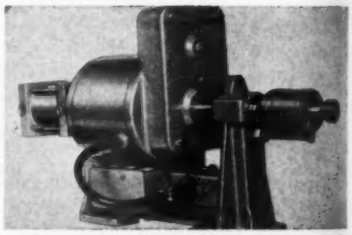
Semi-Automatic Welder

Model MN-1 innershield squirt welder will be shown by Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17, Ohio. The semi-automatic production welder can be used for both machinery and structural fabrication. The unit feeds a tubular, self-shielding electrode through a welding gun that is manually supported and guided along



the work. The compact 24 oz welding gun closely duplicates the feel of a standard 500 amp electrode holder. Welding range is from 350 to 600 amp. The tilted control panel of the welder houses current and arc voltage controls, an electrode inch button, polarity switch, and volt and ammeters. A metal shield protects operator's hand from heat. Inform-A-Gram No. P37.

Small Taps



A new automatic tapping unit has a speed range from 750 to 3000 rpm in seven steps. The compact unit can easily be built into special machines. It has free axial motion to permit tap to follow its own lead. Adjustable torque control prevents tap breakage. A pressure regulator is supplied to control feed. A single direction motor is used with reversing attachment. For more about Model 114 with capacity range from #4-40 through #10 check Inform-A-Gram No. P38, or write The Electro-Mechano Co., 241 East Erie St., Milwaukee, Wis.

Reduce Tool Costs with WETMORE ECONOMY MODEL AND 10050 Port Contour Cutters

Stocked for Immediate Delivery, Carbide Tipped for Tubing OD Sizes ⅛" through 2"

These economically priced tools reduce tool costs while offering specific advantages for prototype, model or tool room work. Spot face diameters are larger than conventional AND sizes and will machine larger bosses or provide extra diameter for special grinds. These tools are excellent for the production of Stainless Steel AND 10050 Parts.

Wetmore manufactures and stocks an extensive line of precision Port Cutters and Flat Form Tools for standard hydraulic fittings in both high speed steel and carbide. The wide range of selection of Wetmore Tools will provide the cutters best suited to your requirements and insure the fine finish and accuracy needed for the highest quality fittings.

Write for New Wetmore Catalog—Complete information given on ordering, prices, tool description and applications.

Wetmore Tool & Engineering Co. Phone: ANgelus 9-7266 TWX: LA 2085
5320 E. Washington • Los Angeles 22, California

Wetmore Tools

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PERMAG PACIFIC CORP., 2910 S. LA CIENEGA BLVD., CULVER CITY, CALIF.

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INCREASE TOOL LIFE

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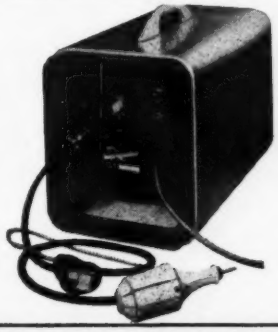
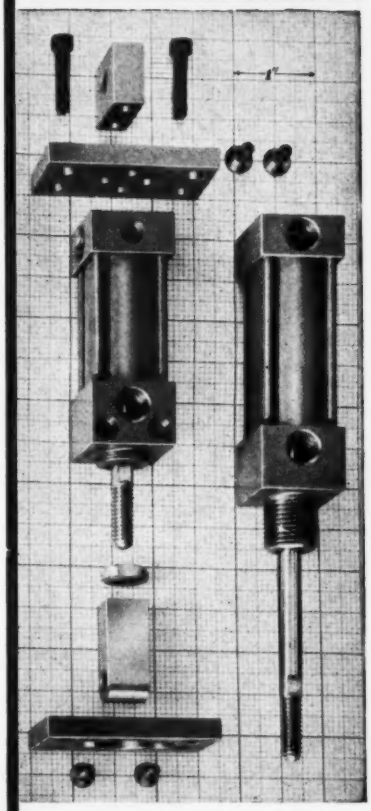
Tests prove that carbide impregnation with O.K. Tool Company's exclusive new Wickman Impregnator increases the effective life of standard H.S.S. tools 6 to 8 times. Economical to purchase and operate. Plugs in anywhere . . . requires no special skill.
Send us a tool for carbide impregnation — or contact your nearest O.K. Tool Company representative.



THE OK TOOL COMPANY, INC. MILFORD, N.H.

CIRCLE INFORM-A-GRAM KEY NO. 1273

HOW SMALL do you want 'em?



Hannifin offers new "Midget-Air" 200 psi cylinders in ¾", 1" and 1⅛" bores, double-acting or spring-return. Two basic models, "universal" and "nose-mounting." Universal models come drilled and tapped for mounting, or for use with any combination of the mounting attachments pictured. Delivery is off-shelf in standard strokes, shipment in ten days to specified stroke lengths. Want dimensions and prices? Write:

PARKER HANNIFIN CORPORATION
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS
2296-P11a
HANNIFIN COMPANY
A DIVISION
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CIRCLE INFORM-A-GRAM KEY NO. 1274

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- ELIMINATES READING ERRORS
- SIZE: 5 INCHES
- AVAILABLE WITH ADJUSTABLE TOLERANCE DIAL, MODEL TUR 53E, $3 EXTRA
- STAINLESS STEEL MODELS AT SMALL ADDITIONAL COST

Includes Wooden Case
from $36.15

ADJUSTABLE TOLERANCE

DIAL MODEL TUR68E

Includes Wooden Case
from $41.85
Model UR 68E without adjustable dial $38.85

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- ELIMINATES READING ERRORS
- SIZES: 6", 8", 10"
- STAINLESS STEEL MODELS AT SMALL ADDITIONAL COST

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U.S. Representative **KARL A. NEISE, INC.**
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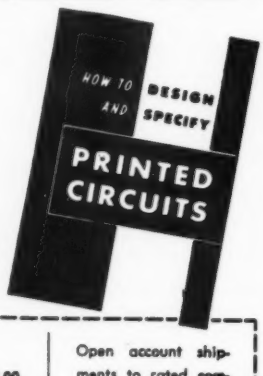
CIRCLE INFORM-A-GRAM KEY NO. 1281

How to Design and Specify

PRINTED CIRCUITS

OVER 70 ILLUSTRATIONS are included in this new publication, reporting on: Advantages of Printed Circuits . . . Layout and Design . . . Selection of Materials and Components . . . Multiple Soldering Techniques . . . Reliability . . . Production Methods . . . Process Limitations . . . Printed Circuit Assembly . . . Service and Repair . . . Artwork . . . Finishes . . . Information on Switch Plates and Commuter Discs . . . and other valuable information. Also includes NEW RECOMMENDED TOLERANCES FOR PRINTED CIRCUITS. **$5.00**



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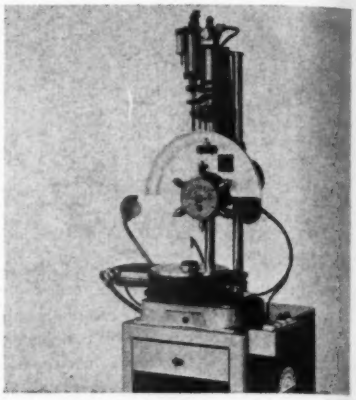
Product News

Deep Hole Drilling

A new reciprocating feed is optional on all Burgmaster automatic bench model turret drilling machines, and permits drilling to a certain depth, retracting the top of the workpiece, rapid traversing down to the previous drill stopping point, drilling another increment, and retacting to top of work for



chip clearing. The cycle can be repeated until final depth is reached. At this point the drill is rapid traversed to the top of the stroke, indexed to the next tool and continues the machine cycle. Depth of stroke and rapid traverse are set electronically. Write Small Tool Div., Burgmaster Corp., 15001 S. Figueroa St., Gardena, Calif., or Inform-A-Gram No. P39.

Small Boring Bars

New Series BB-7500 small boring bars are intended for jig boring machines and similar applications. They offer rigidity for close tolerance boring. The Kennametal shank is said to virtually eliminate chatter, and reduce deflection and vibration. Standard Kendex positive-rake screw-on triangular inserts are used. BB-7500 series appear in five bar diameters: ⅜, ½, ⅝, ¾, and 1", in lengths of 4, 5, 6, 7, and 9". Write Kennametal, Inc., Latrobe, Pa., or No. P40.

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USE THE PERFECT COMBINATION For MICRO-DRILLING

SPHINX

HIGH SPEED STEEL MICRO-DRILLS

Drills from .0016" to .0591" are stocked in increments of .0004"(.01 mm). From .0610" to .1181" in increments of .0020" (.05 mm). Left hand micro-drills for use on Swiss type automatic screw machines. Short flute center drills. Send for Bulletin "Q" listing complete line of drills or Catalog T listing collets as well as full line of instrument lathes and accessories.

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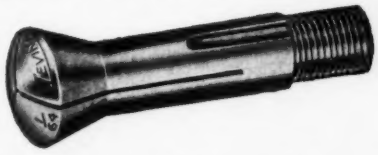
LEVIN ®

SUPER PRECISION COLLETS



Super precision collets for jewelers type lathes. Ideal for holding micro-drills or other parts where concentricity is important. Available from stock in complete range of sizes from .004" (.1 mm) to 5/16" (8.0 mm).

CIRCLE INFORM-A-GRAM KEY NO. 1291

ANNOUNCING

THE HOLOMATIC COMPACT

SIZE "J"

AIR AND HYDRAULIC POWERED FEED UNITS

- Built-In Versatility
- Amazing Power to Size Ratio
- Quick Speed Change Drive
- Adjustable Rapid Travel Distance
- Adjustable Stroke Length
- Adjustable Feed Rate
- Wide Work Range (1/64 to 3/8" drill and No. 0 to 7/16" tap in mild steel)

3 Models...3 Power-Feed Styles

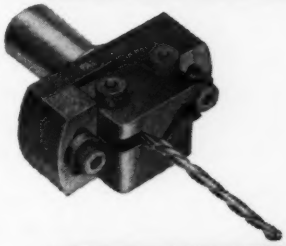
The new Holomatic family of "compacts" . . . the Size "J", are self-contained, reciprocating quill type power-feed units for use on production drilling, reaming, facing, tapping, threading operations. Used individually or in groups with manual or automatic cycling. Available in 3 "compact" models with 3 power-feed styles with built-in cycle and movement control systems to meet every conceivable need more efficiently and economically.

Write Today . . . **for in-plant demonstration . . . or additional information, specifications and low, low prices on the new series "J" units.**

Hause MACHINES, INC.
MONTPELIER, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1292

ACCURATE SET-UPS FAST!



Accurate, rapid set-ups the first time, every time . . . is the reason Brookfield Tool Holders are now widely used in practically every metalworking plant in the country. With one Brookfield Tool Holder, you can cut your stock of bushings by at least 100. Here's why:

BROOKFIELD TOOL HOLDERS

ADJUSTABLE V JAW holds wide range of tool diameters without bushings or accessories.

AXIALLY TRUE DESIGN makes perfect tool alignment almost automatic.

BALANCED-PRESSURE LOCKING ASSEMBLY maintains uniform seating, eliminates creep or shift.

EASY TO USE — just slip tool in the jaw, tighten, then float tool into dead center and lock.

AVAILABLE IN A WIDE RANGE OF SIZES

MODEL NO.	HOLDING RANGE	SHANK DIA.
BA-10	1/64"–3/16"	3/8"
DA-10	1/64"–1/2"	5/8"
DA-12	1/64"–1/2"	3/4"
GA-12	1/64"–3/4"	3/4"
GA-16	1/64"–3/4"	1"
KA-16	1/8"–1"	1"
KA-24	1/8"–1"	1 1/2"
PA-24	1/8"–1 1/2"	1 1/2"
PA-28	1/8"–1 1/2"	1 3/4"

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BROOKFIELD, INCORPORATED

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ALVA ALLEN
HEAVY DUTY
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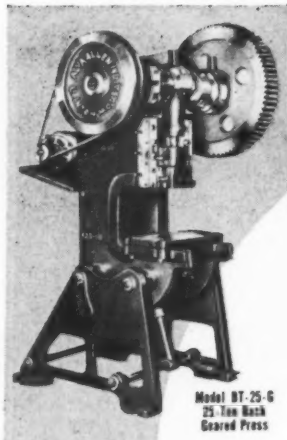
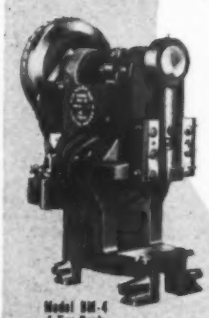
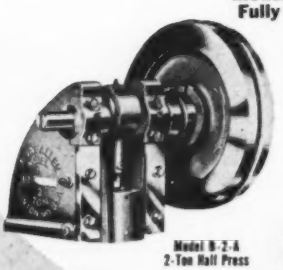
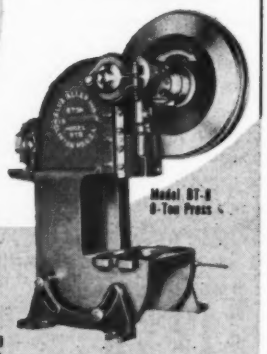

Model BT-25-G 25-Ton Back Geared Press


Model BH-4 4-Ton Back Flywheel Press


Model B-2-A 2-Ton Half Press


Model BT-8 8-Ton Press

Model BD-3 3-Ton Deep Throat Press

model BT-5-DD 5-Ton Double Ram Press

See Yellow Pages for Local Distributor

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⅛ inch shanks, 150 pieces assorted .....$24.50 including shapes

¼ inch shanks, 100 pieces assorted .....$24.50 including shapes

Combination ⅛ and ¼ inch shanks, 250 pieces assorted $47.00

Order 10 assortments of any combination above and receive one assortment FREE

American made—made with virgin grain—absolutely finest materials and workmanship.

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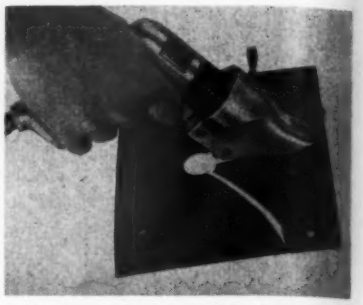
CIRCLE INFORM-A-GRAM KEY NO. 1302

Product News

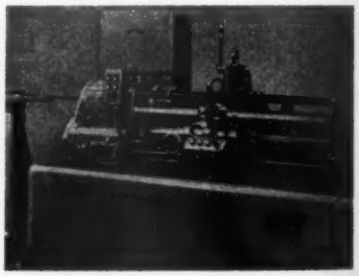
Clean Cuts



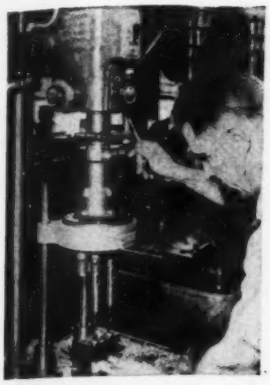
A new sheet metal shear cuts clean and without distortion. It scissors a 7/32" path through 18 gage mild steel, 1/16" laminated plastic, aluminum, tin, Formica, and various types of fiberglass. Cuts may be started from the edge of the sheet or a ¼" access hole. The aluminum shear housing rotates through 360° for convenience in cutting overhead or hard-to-reach areas. The shear is available in pistol-grip (21U-103), or straight-type (21U-503) models from Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio. Inform-A-Gram No. P41.

One Pass Turning

Round, square and hexagon bar stock can be contour turned with the Trace-O-Matic centerless shaft turning machine. The unit features a rotating bar stock support that is adjacent to, and travels with, the turning tool. Bar stock lengths



up to 40" can be machined in one pass. If finished parts are sufficiently short, two or more parts can be produced in one pass from duplicate or dissimilar templates placed end to end. With almost fully automatic operation and simplified pushbutton controls, an operator can handle more than one machine. Taber Instrument Corp., 111 Goundry St., North Tonawanda, N.Y. offers literature. Inform-A-Gram No. P42.



MULTI-DRILL
makes holes at a PROFIT!

This Model 600 MULTI-DRILL, — an adjustable multiple spindle drill press attachment—fitted with optional Guide Rods, is drilling two ½" holes in a work piece at every stroke of the drill press—and is reducing hole costs to the basic minimum. The same unit is used on three other set-ups to drill holes ranging from 3/32" dia. to ⅝". Quickly adjustable spindles and heavy duty construction make this MULTI-DRILL a versatile time and money saving production tool that pays for itself many times over. Ask your nearby Commander Distributor to show you how a MULTI-DRILL can help solve your multiple spindle drilling problems. There's a model and size for any application or drill press.

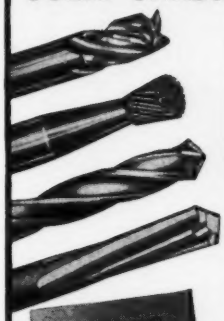
Write for Production Tool Catalog.

108

Commander MFG. CO.
4228 WEST KINZIE • CHICAGO 24, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1311

"Raymac"
SOLID CARBIDE CUTTING TOOLS



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Up to 25% Longer Life

Finest quality solid carbide ground and lapped to the sharpest cutting edges make "Raymac" tools the quality standard of the industry. More parts produced per tool and per regrind.

Make "Raymac" your standard.

SEND FOR NEW CATALOG NO. 61

"Raymac" Division – DEXCO CORPORATION
15778 Telegraph Rd. Detroit 39, Michigan

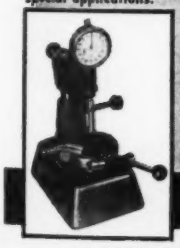
CIRCLE INFORM-A-GRAM KEY NO. 1313

DiaTest BORE GAGES for:

DIAMETERS: .038" to 1.620"
ACCURACY to .00008"
OPERATING SIMPLICITY

NO SPECIAL TRAINING NEEDED TO GET PERFECT RESULTS!

Production Stand, Right-Angle Attachment, Extension Rods, Depth Adjuster and Special Measuring Heads are available for special applications.



DiaTest WILL INCREASE your accuracy and save you time and money in measuring all bores within its range; perfect for out-of-round, tapers, incomplete bores and all other variations.

WRITE TODAY or call (Area Code 312) 631-8888 for complete information!

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CIRCLE INFORM-A-GRAM KEY NO. 1312

Easy to move heavy loads

With the New SHOPLIFTER DeLuxe

DeLuxe MOBILITY
Big 8" and 5" rubber wheels for easy movement across rough floors and also protection for finished floors.

DeLuxe LIFT
Full 60" — yet overall height is only 78" for easy movement thru doorways and in narrow aisles.

DeLuxe CAPACITY
750 lbs. rated capacity. All steel construction, electrically arc-welded permits overloads.

DeLuxe FEATURES
Positive control hoist unit, backguard platform plate, tool tray, turned-down platform edge, painted safety orange.

Order Your Deluxe Shoplifter Today!
Immediate shipment from factory stock.

Price: $280.00 f.o.b. Chicago

Ten-day free trial, if desired, with full credit return privilege.

Model DL

ECONOMY ENGINEERING
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CIRCLE INFORM-A-GRAM KEY NO. 1314

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SOLDERING • FORGING • ANNEALING
MELTING • SINTERING • WELDING
REFINING • SHRINK FITTING
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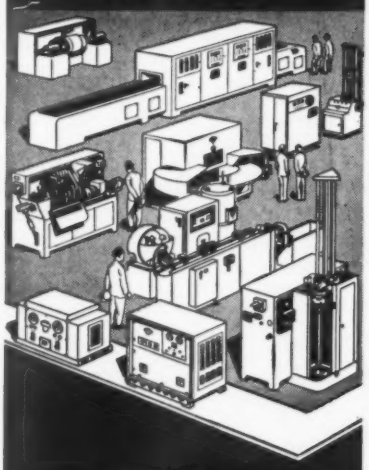

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ELECTRONIC • LOW FREQUENCY
MOTOR GENERATOR

THER-MONIC features

• Over 20 years of concentrated experience.

• Over 5,000 installations.

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• This outstanding experience and know-how qualify us to prescribe the techniques and equipment best suited for your requirement.

Contact our factory or your local IHC representative.

Write for New 56-page catalog of exclusive features, facts and specs.

INDUCTION HEATING CORP.
181 WYTHE AVE., BROOKLYN 11, N.Y.

Subsidiary of HATHAWAY INSTRUMENTS, INC.
CIRCLE INFORM-A-GRAM KEY NO. 1321

He's Watching a Band Sawing Miracle

This band saw operator at the Bell & Gossett Company plant in Morton Grove, Illinois, is watching "Controlled Accuracy"... accuracy, being held to within a few thousands of being perfectly straight, and he can actually *see* the band blade being guided in the saw cut to produce this accuracy! No further machining is required before the pipe is welded into an assembly for a Bell & Gossett Heat Exchanger Unit.

Band sawing accuracy like this is nothing short of miraculous—especially when it can be done on a high production basis, as Bell & Gossett is doing. And when the same tolerances can be held on cut-off pieces from 2" to 18" in diameter, this MARVEL #81 Band Saw Machine can be truly called a precision machine tool.

The secret of this amazing sawing accuracy is in the MARVEL "SURE-LINE" Automatic Accuracy Control—a simple and extremely effective electro-mechanical servo-mechanism that continuously senses and automatically corrects any tendency of a band blade to drift to either side of a desired line of cut. The "SURE-LINE" unit literally "steers" the blade to make a straight cut. This permits the use of heavier feed pressures and, when desirable, higher blade speeds, to do the work faster, without sacrifice of accuracy. Incorporated in the new MARVEL #81 Series High Speed Heavy Duty Hydraulic Band Saws, the "SURE-LINE" permits full utilization of all the advantages of high speed steel band saw blades—while extending their usable blade life as much as 50%.

Before you buy any band saw machine, get complete details on MARVEL #81 Series Single Cut, or Automatic Shuttle Type Bar Feed Production Band Saws—the machines DESIGNED AND BUILT TO REDUCE SAWING COSTS. *Write for catalog today.*

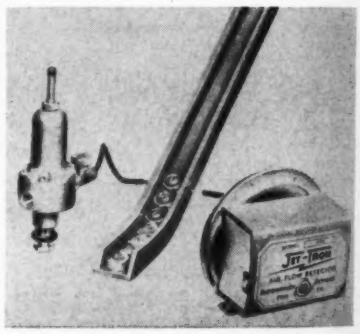
ARMSTRONG-BLUM MANUFACTURING CO.
5700 West Bloomingdale Avenue • Chicago 39, Illinois

MARVEL Metal Cutting SAWS

CIRCLE INFORM-A-GRAM KEY NO. 1322

Jet Control

Jet-Tron, a newly designed pneumatic control switch, can be used for feed-back pressure control, conveyor control, multiple machine coordination, safety switching, level control and solenoid operation. The switch produces an electric signal when objects interrupt the air flow. This signal can be used to automatically control production equipment. Jet-Tron detects presence of any solid object without physical contact, regardless of the material. The 7 amp, 120 volt, single pole double throw snap action control switch is made by Automation Devices, Inc., 3125 Brandes St., Erie, Pa. Inform-A-Gram No. P43.



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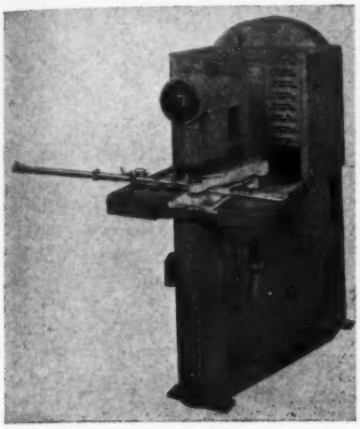
Product News

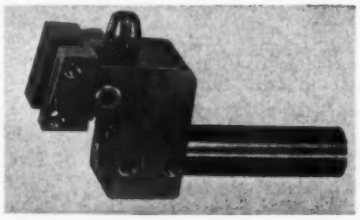
Fabricator

A new gaging system for Fabricator Models 15A, 10A and 10AA consists of a 1¼" quick change holder with micro-set gaging. It allows settings to thousandths in seconds. With only a chart of X and Y coordinates, the operator positions the dial indicator. The



1¼" quick change holder is an integral part of the new system. It is an indexed guide and die bushing that permits punches and dies to be rotated to any desired degree location in relation to the edge of the workpiece. There's no need for specially keyed holders. Write Wales Strippit, Inc., 212 S. Buell Rd., Akron, N.Y. and ask for catalog MS. Or circle Inform-A-Gram No. P44.

Speed Set



Andy Speed-Set, a new adjustable knee tool, can be used on small turret lathes, chuckers and automatics. As a multiple tooling setup on turrets it will rough turn and center drill, chamfer, finish turn and ream. It saves time in setup and downtime, and is guaranteed to cut production costs, according to Ross Tool Mfg. Co., P.O. Box 1562, Glendale 3, Calif. Write them, or check Inform-A-Gram No. P45.

How-To-Do-It Reference Books

Adhesive Bonding of Metals	$ 2.95 ea.
Principles Of Inventory Management	$ 2.00 ea.
Brazing Manual	$ 4.75 ea.
Diamond Technology	$10.00 ea.
Dictionary Of Metallurgy	$25.00 ea.
Die Designing & Estimating	$ 7.50 ea.
Electroplating Engineering Handbook	$10.00 ea.
Fasteners Handbook	$12.50 ea.
Gears For Small Mechanisms	$ 6.00 ea.
How To Design & Specify Printed Circuits	$ 5.00 ea.
Instruments For Measurement And Control	$10.00 ea.
Plastics Tooling	$ 7.50 ea.
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For other books, information on ordering and our 10 days Trial Offer please refer to the Huebner Publications ads.

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CIRCLE INFORM-A-GRAM KEY NO. 1331

PUSH BUTTON *Speed Selection*

from **to** **in seconds**

or to *any* intermediate speed, *instantly*

Just push a button and watch the large tachometer dial on the headstock!

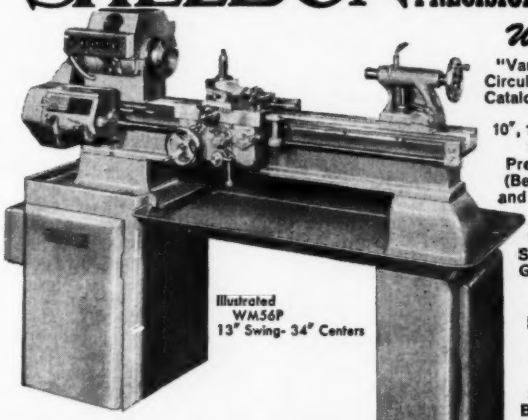
It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

SHELDON *Variable Speed* **PRECISION LATHES**



Illustrated WM56P 13" Swing- 34" Centers

Write for

"Variable Speed" Circular and General Catalog showing . . .

- 10", 11", 13" and 15" SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)
- 13" and 15" SEBASTIAN Geared Head Lathes
- SHELDON Milling Machines
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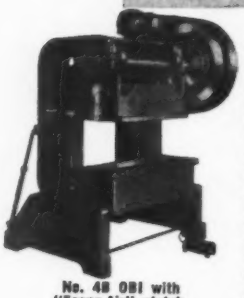
SHELDON MACHINE CO., INC.
4235 N. Knox Avenue. • Chicago 41, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1332

High-Output with ROUSSELLE

DOUBLE-CRANK PRESSES



No. 48 OBI with "Econo-Air" clutch.

SPEED UP PRODUCTION with these versatile 40-ton presses. Large bed and ram areas make them ideally suited to handle wide rolls or sheets . . . do multiple punching, steel-rule die work and other high output operations. For rapid, shockless starting and stopping, presses can be equipped with electrically controlled "Econo-Air" friction clutch . . . Ask for new catalog.

Choice of over 30 models and types in 5 to 60-ton sizes

STRAIGHT SIDE – Die space up to 24 in.; bed space up to 6 ft. between uprights.

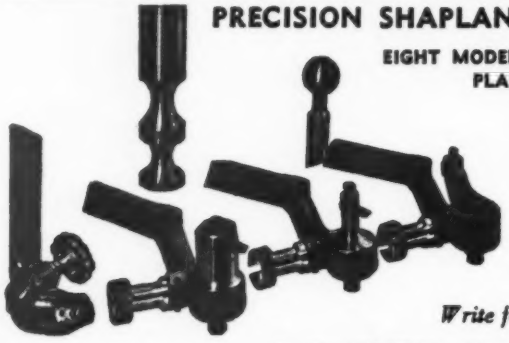
SERVICE MACHINE COMPANY
Mfrs. of Rousselle Presses
2310 WEST 78TH STREET • CHICAGO 20, ILLINOIS

Rousselle Presses are sold exclusively through Leading Machinery Dealers.

CIRCLE INFORM-A-GRAM KEY NO. 1341

PRECISION SHAPLANE RADIUS TOOLS

EIGHT MODELS FOR LATHES, SHAPERS, PLANERS AND BORING MILLS



Range: 1/8" to 3" for concave radii on lathes. Two sizes for convex radii (Balls up to 2½" dia.) on lathes. Also heavy duty model for radii to 6" on planers, etc.

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Patent Pending

C. B. TEETER - Tool Room Specialties

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CIRCLE INFORM-A-GRAM KEY NO. 1342

Producto's New DIE ASSEMBLER

Hydraulically actuated lift table; upper platen revolves 360°, develops 3000-lb. closing force and 1500-lb. separating force. Battery-driven; mobile, no trailing wires. Invaluable in the manufacture and repair of dies. Write today:

TOOLROOM EQUIPMENT DIVISION

THE PRODUCTO MACHINE COMPANY

945 Housatonic Ave., Bridgeport, Conn.

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CAM milling/JIG boring

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EXPERIMENTAL DEVELOPMENT

CAM CALCULATING SERVICE

Write for catalog 55-C

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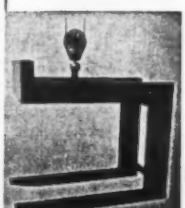
Oscar Eisler, Jr. President
732 So. 13th St. Newark 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1344

LIFTING DEVICES



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400 MODELS

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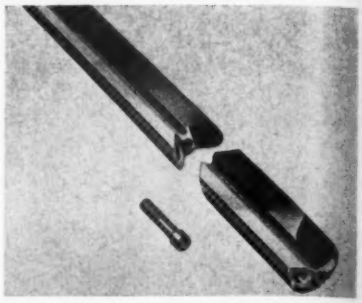
CIRCLE INFORM-A-GRAM KEY NO. 1345

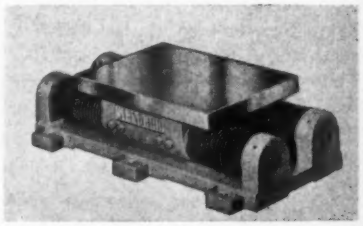
Product News

Gun Drills

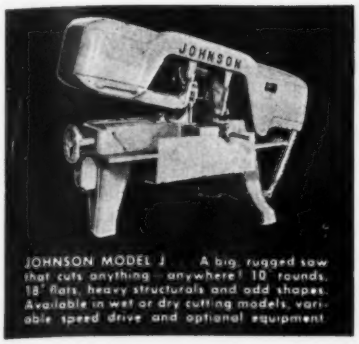


Resharpening of large one-piece gun drills, once an awkward operation, can now be done without removing the shank from the machine. New gun drills with quick-change detachable heads reduce tool inventory, since a single shank accommodates several cutting heads. Quick-change cutting heads are joined to the shank in a V-type assembly by means of socket head cap screw. According to National Twist Drill & Tool Co., Rochester, Mich., the gun drills are offered in center-cut and target-type design. Write, or check Inform-A-Gram No. P46.

Building Block Assemblies

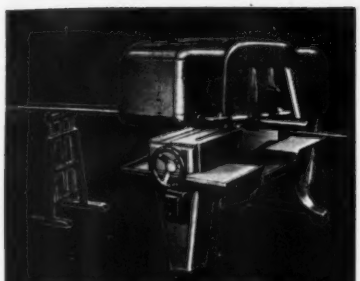


Existing machines can be converted into new individually designed units via building-block equipment from Precision Spindle Div., The Standard Electrical Tool Co., Mt. Hope and Sixth Sts., Cincinnati 4, Ohio. Illustrated is one type of ball bushing slide, available for hand movement, or equipped with power feed in the variety of commercial designs. Assemblies may be ordered for mounting in any plane or at any required angle. Other accessories include feed lock, taper gib, ratchet wrench, feed adjustment, hydraulic power traverse with rapid and controlled feeds, and cycling equipment. Write the makers, or circle No. P47.

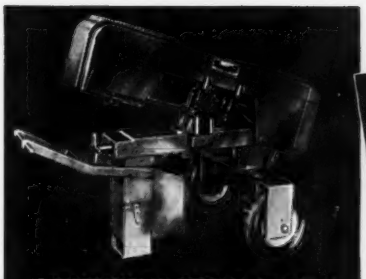


JOHNSON MODEL J . . . A big, rugged saw that cuts anything . . . anywhere! 10" rounds, 18" flats, heavy structurals and odd shapes. Available in wet or dry cutting models, variable speed drive and optional equipment.

JOHNSON MODEL B . . . Also available in wet or dry, metal cutting models, variable speed drive. Will easily handle 5" rounds, 10" flats, odd and irregular shapes.



JOHNSON ADJUSTABLE STOCK STAND . . . A necessity for operational safety and production efficiency. Solidly built, easily adjusted even under load. Practical and inexpensive.



JOHNSON "MOBILE" MODEL M . . . Same husky capacity as Model B, but wheel-mounted for fast, easy maneuverability indoors or out. Has self-contained handle, power line, tool box and accessories.

Only Johnson offers *all* of the outstanding construction features and performance advantages—*at a lower initial price.*

Why pay more when you can have the best for less? Compare Johnson saws with others costing hundreds more, and you'll find that *only* Johnson delivers the life-long, maintenance-free efficiency you've always wanted.

Immediately available in five high capacity models to meet any metal cutting requirement—efficiently and economically.

Write Today...for your copy of the big, new Johnson catalog. Illustrates and describes all models and accessories.

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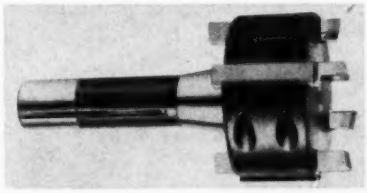
Hastings Distributors
1605 Solano Avenue
Berkeley, Calif.

CIRCLE INFORM-A-GRAM KEY NO. 135

Product News

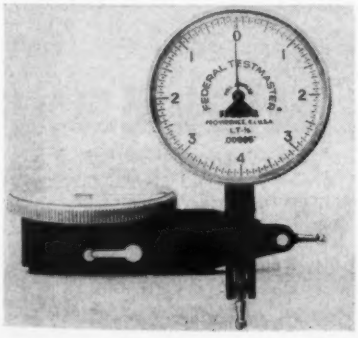
Fly Bars

Fast and efficient stock removal can be done with a new progressive step fly bar. The unit utilizes standard low-cost cutting tools. Radial steps in the one-piece body of the heat treated body of the fly bar take four small chips instead of one large one. This eliminates vibration and excessive wear on machine spindles. Setup time is reduced and standard tools are easily sharpened. The fly bars are



offered in two models—a 40 National taper, #9, Brown & Sharpe, and an R-8 taper with ⅜" wide slots to accommodate tools. Lido Tools, 1972 Placentia, P.O. Box 403, Costa Mesa, Calif. is the manufacturer. Write, or circle Inform-A-Gram No. P48.

Test Indicators



New test indicators with 40% less gaging tension and 25% less friction than previous models are introduced by Federal Products Corp., Providence 1, R.I. Testmasters T series come in 1 and 1½" dia models. Secret of improved accuracy is a new counter-balanced indicating hand and full-jewelled bearings throughout. Mounting dovetails are cast integrally with the cast to prevent loosening. Write the makers, or check Inform-A-Gram No. P49.

Now Partial Automation

Many advantages of automation are now within reach of all shops through maximum utilization of existing machines. The Rheem position display offers partial automation where particular machine considerations do not warrant full numerical control. It allows more rapid positioning and reduces operator fatigue. Dials are easy to

read. The unit is used with a position transducer geared to a leadscrew or precision rack. The transducer senses magnitude and direction of motion, and provides a signal for machine zero. It comes for one, two or more axes with typical resolutions of 0.001 or 0.0001 and displacements up to 999.999 for the 0.001 resolution. Rheem Mfg. Co., Electronics Div., 5200 W. 104 St., Los Angeles, Calif. or No. P50.

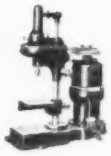
For HIGH SPEED

DRILLING

Precision and Sensitive

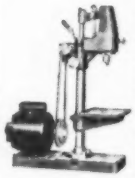
High Speed Model R-53

Built for precision, sensitive drilling, from No. 80 to ¼" diameter drills. Spindle and chuck indicated and guaranteed to .00075". Drills to center of 6" circle, spindle travel 2¼". Speeds 750, 1500, 3000 and 6000. Accurate, adjustable depth gauges. Bench or pedestal type. Also in multiple spindle units—with two to six individually motor driven spindles.



High Speed Model AF-7B

Built for precision drilling from No. 0 to 5/16" diameter drills. Drills to the center of an 11¾" circle. Vertical travel ahead — 8". Spindle travel — 2¾". Speeds 750, 1500, 3000, 6000 RPM. Spindle chuck indicated and guaranteed to .00075".



High Speed Model "U.S."

Built for precision drilling from No. 80 to ¼" diameter drills. Drills to the center of a 6" circle. Spindle feed 2¼". Maximum distances chuck to base—14". Available with two drives to give either 2450, 2815, 3080, 3540, or 2450, 3630, 4810 and 6000 RPM. Spindle and chuck indicated and guaranteed to .00075".

All these machines built in accordance with U. S. Government Specification OO-D-676a.

High Speed Hammer Co., Inc.

307 Norton St. Rochester 21, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1361

HARDENED and GROUND HSS BLANKS

Any decimal diameter — any length. Mirror finish surface to gage tolerance.

Many uses —

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Write or phone DRexell 6-4223 for price list D-3

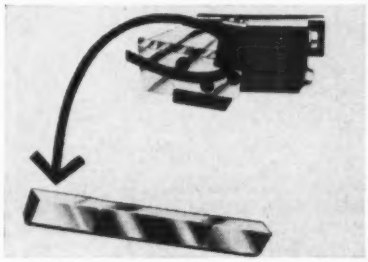
WILLIAM T. HUTCHINSON CO.

53 Brown Ave., Springfield N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1362

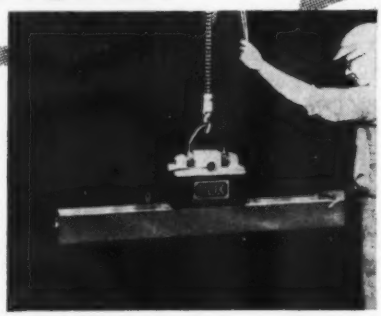
Product News

Pre-Ground Inserts



New Manchester high-speed steel, double-end cutting inserts use both ends for cutting. They're completely pre-ground and ready to use. Back taper, front and side clearance is pre-ground at both ends. Inserts are standard size ⅛, 3/16, ¼" wide and ⅝ to 2" deep. They're interchangeable on all Manchester cut-off tools. They also fit all makes of turret lathes, production lathes, automatics, and cut-off machines. Write Portage Double Quick, Inc., 1046 Sweitzer Ave., Akron 11, Ohio. Or mark Inform-A-Gram No. P51.

NEW BUX PERMANENT LIFTING MAGNET



FEATURES:

- Absolutely Permanent Ceramic Magnets
- Lifts better than 3000 lbs.
- 6½"x13" lifting face
- No wires • Completely self contained power pack
- Never needs recharging • No maintenance costs
- SAFE — Magnet cannot be turned off when in use
- No Batteries Required

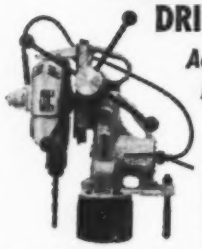
RADIAL POSITIONER

Portable Magnetic

DRILL PRESS

Accurate Drill Positioning

FAST!



New positive mechanical-action Bux radial positioner assures faster, accurate alignment of Bux portable-magnetic drill presses. Magnetic base remains stationary, safely holding unit to work on any "overhead" or "vertical" flat working surface. Full 330° positioning rotation. Lateral movement provided assures precision positioning for drilling, reaming, tapping. Available on Bux magnetic drill press models L-2RP and L-3RP.

BUX magnetic products

for FREE Literature and Name of nearest Dealer . . . Write:

BUX MAGNETIC PRODUCTS, INC.

1355 N. 10th St. San Jose 12, Calif.

CIRCLE INFORM-A-GRAM KEY NO. 1366

DRILL THESE HOLES

BY A QUICK, EASY, INEXPENSIVE METHOD

Your business letterhead will bring literature.

WATTS BROS. TOOL WORKS

Wilmerding, Penna.

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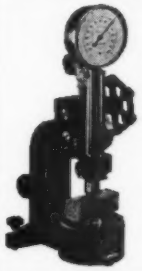

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has been done with the SCLEROSCOPE

Since 1907

THE SHORE INSTRUMENT & MFG. CO., Inc.

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HOLES

ECONOMICAL • FAST DRILLING

DEEP HOLES IN ONE PASS!

Reps. and Distrb's. Inquire!

Clark SPADE DRILLS

P. O. BOX 990, BEVERLY HILLS, CALIF.

CIRCLE INFORM-A-GRAM KEY NO. 1365

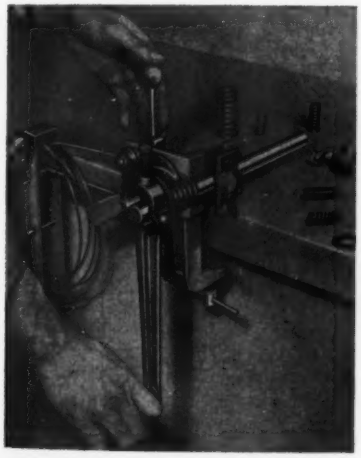
Product News

The Right Oil at the Right Time

The metalworking industry can get acquainted with the entire line of cutting oils from Texaco, Inc. at Booth 473, ASM Show. How to use the right oil for the right operation will be graphically and personally explained by Texaco experts at the show. The right oil eliminates distortion and dimensional inaccuracies in the workpiece. It reduces tool wear and power consumption. It prevents welding of metal to tool point, and rough surfaces on finished face of work. If you don't plan to attend, write the company at 135 East 42nd St., New York 17, N.Y., or check Inform-A-Gram No. P52.

Spring Winder

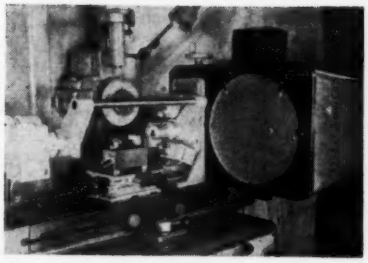
The Porter spring winder is simple to operate. It winds extension, compression, and torsion springs from ⅛ to 1¼″ ID in either right or left hand coils. It takes round, square, or flat wire up to 3/16″. A pitch gage accurately regulates distance between coils. It may be disengaged while winding extension springs or closed end coils on



compression springs. Advance Car Mover Co., Appleton, Wis., offers the Porter as a complete spring winding outfit, as Model P-2 cam lock type, or utility Model P-1 minus cam lock tension release. All units clamp on a bench, or can be held in a vise. Write for added information, or circle Inform-A-Gram No. P53.

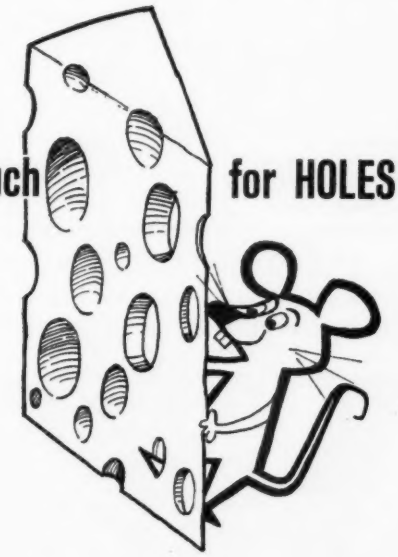
Optical Form Grinder

OFG-300, a simple form grinder projector comparator, may be used on most standard surface grinding machines. Operation is simple. Conventional grinder controls are used to develop shapes and forms from the enlarged projection on the screen. The projector is bolted to the T slots on the grinder table and is easy to remove. The projector also serves as a conventional comparator on a work bench. The unit comes complete with focusing work table, surface illumination



attachment, graduated screen, and lens magnifications of 10X and 20X. From Portman Instrument Co., 1997 Palmer Ave., Larchmont, N.Y. Inform-A-Gram No. P54.

Spending too much for HOLES?



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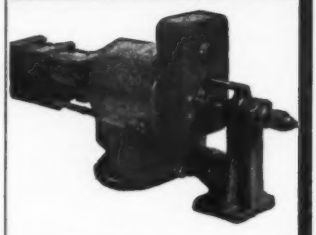

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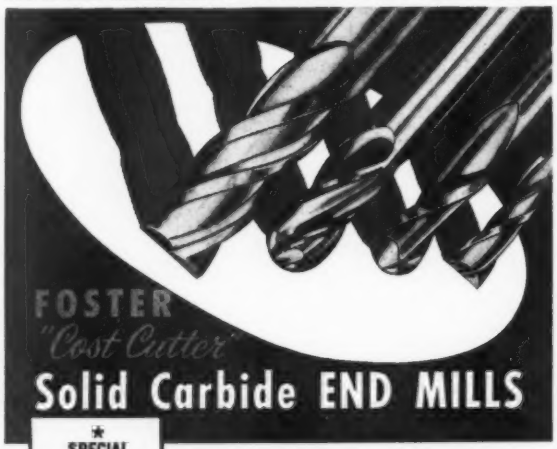

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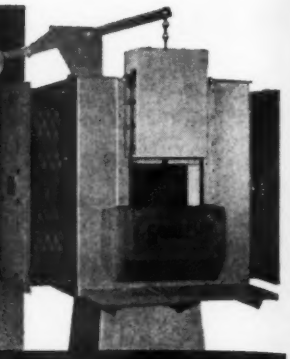

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With the Stocker & Yale Model 3M Optical Projector, the optical axis and the drilling axis are pre-aligned and focus is achieved at the work plane by simple adjustments built into the projector. Once adjusted, the set-up is permanent.

The board is placed on the work table and exact hole location is determined by orientation of the drill spot with the projector screen target. The magnified work area appearing on the screen provides the operator with *Visual Control* necessary for exact hole location. The board can be held manually or secured mechanically. The drill is then actuated and the hole drilled from the bottom. Burrs are controlled by using correct drill geometry and spindle feeds and speeds. Inspection of the completed hole is simultaneous with the drill retraction.

This procedure eliminates the need for templates or pantographs on short or medium production runs. For long production runs, this method can be used to make accurate templates. Drilling several boards simultaneously is feasible by stacking. Greater accuracy improves yield and total output.

Other standard and special Optical Projectors are available for precision gaging, inspection and production. Write for OPM Bulletin No. 603. *Stocker & Yale, Inc., 43 Green Street, Marblehead, Mass.*

CIRCLE INFORM-A-GRAM KEY NO. 1384

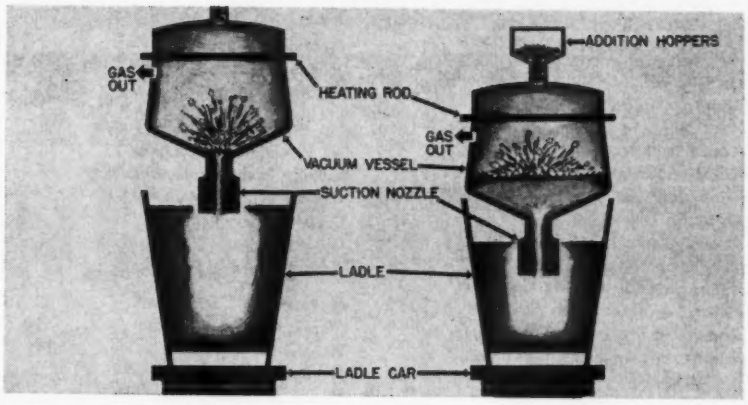
Degassing Technique Promises More Reliable Steel

Nonmetallic inclusions and gas content in finished steel products often result in stress concentrations that cause the product such as bearings, to fail prematurely. The Crucible Steel Co. has a new vacuum degassing technique, applicable to both open hearth and electric furnace steels, which will result in high volume production of steels "free" of these discontinuities.

Crucible recently unveiled its German-developed D-H degassing unit, said to be the largest of its kind in the world, at its Midland, Pa., plant, after 6 mo of experimentation with it. E. A. March, director of technology at the Midland facility, crystallized the importance of the development when he said users of D-H processed steels could confidently take advantage of the steel's inherent strength and durability.

He expanded by saying that bearings made from 52100 alloy steel, if designed to function for 200 hrs, would do so reliably—design engineers wouldn't have to fear occasional failure at 50 hrs.

A range of carbon and alloyed steels from 1020 to 52100 have been processed so far by Crucible, and at least one heat of H-11 tool steel has been put through the D-H unit. Crucible looks to even further upgrading reliability of its entire range of specialty steels with the unit built by Lectromelt Div., McGraw-Edison Co.



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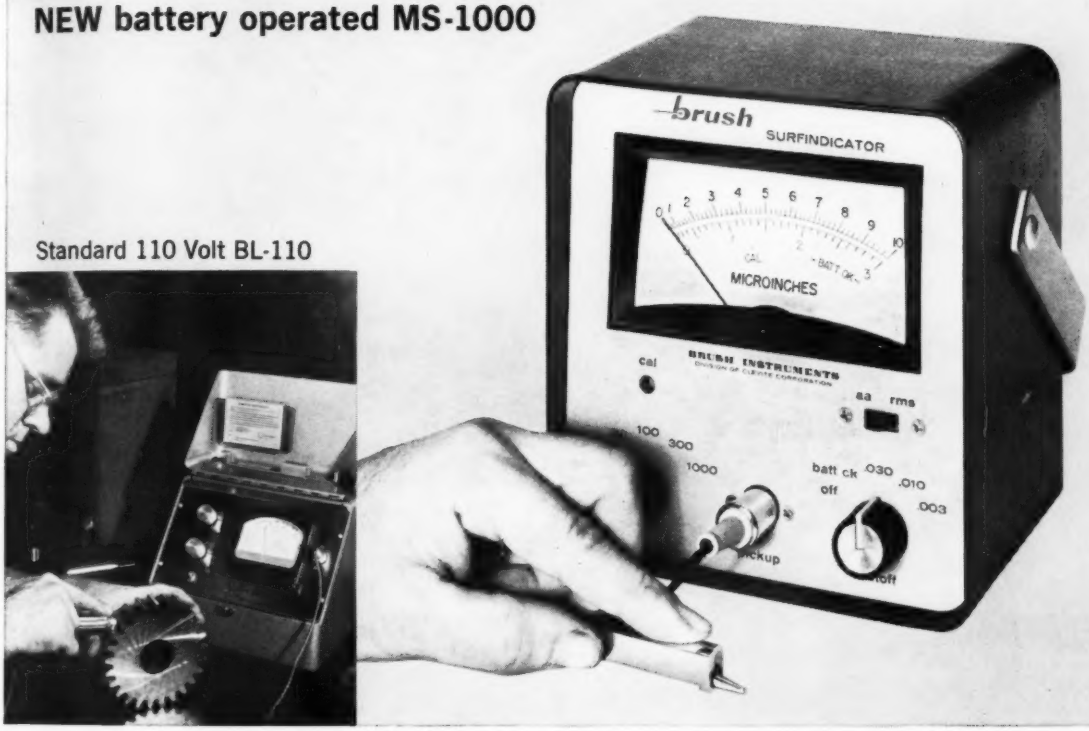

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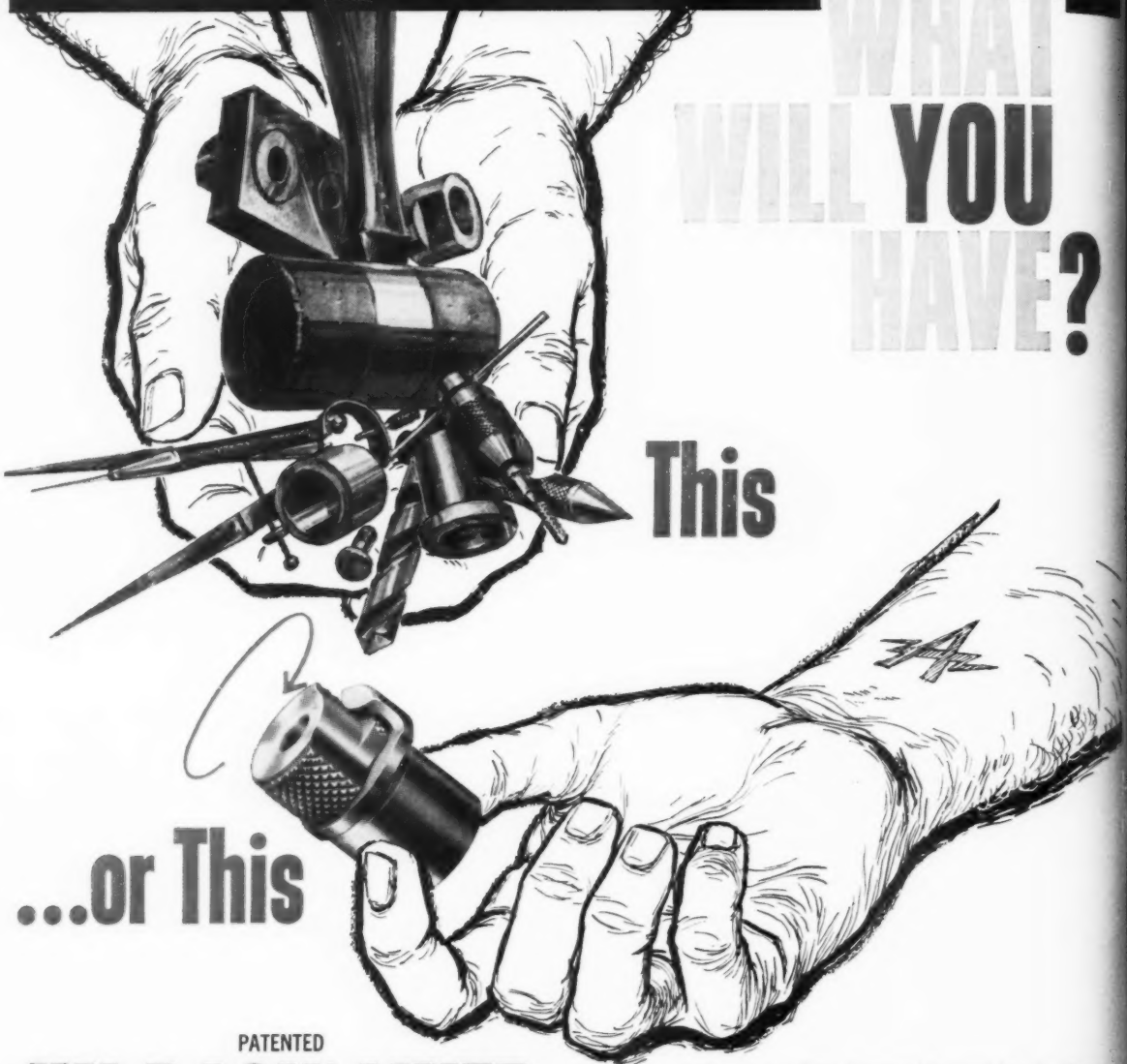

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